The Abdus Salam Memorial Meeting
(19 - 22 November 1997)

TRIBUTE TO ABDUS SALAM

Commemoration Day
21 November 1997

Edited by
A.M. Hamende

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THE ABDUS SALAM INTERNATIONAL CENTRE
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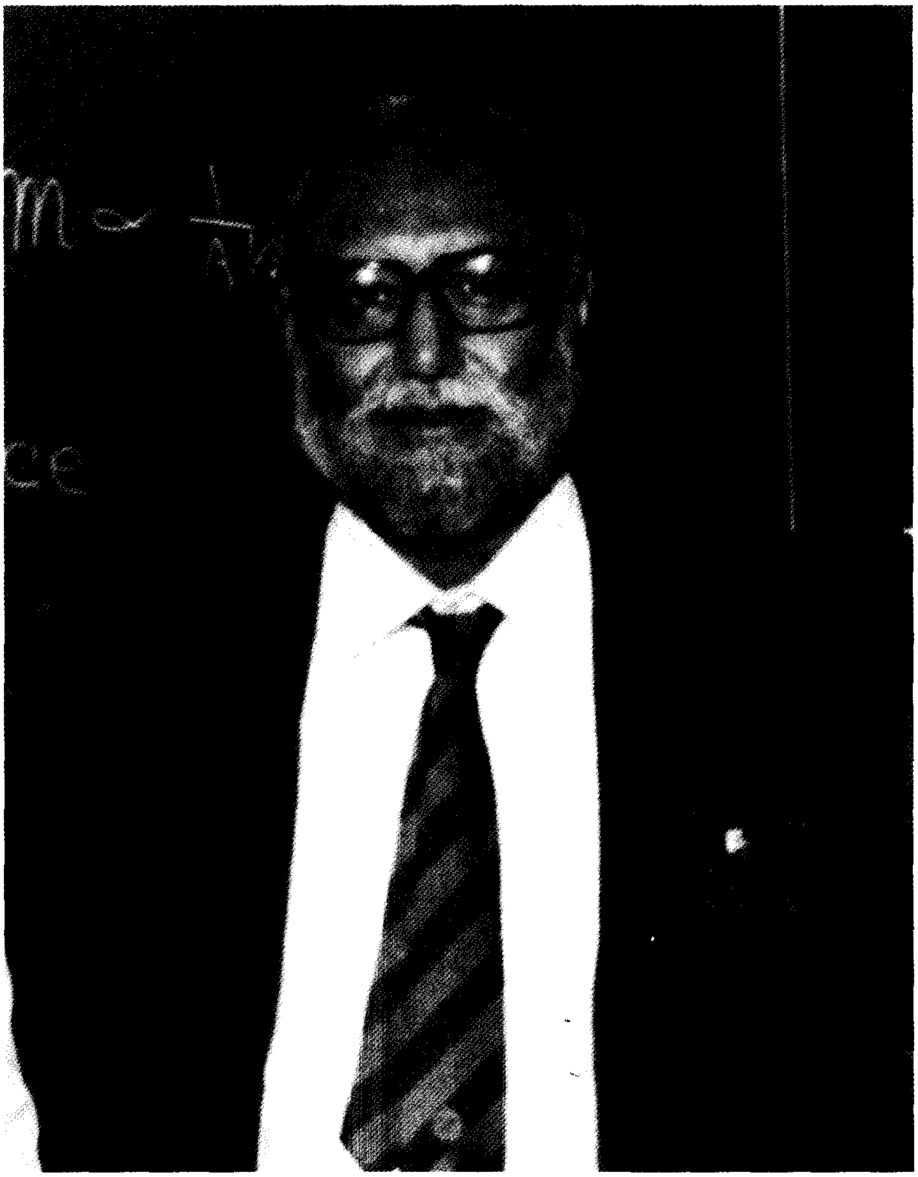

Abdus Salam

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Foreword

From 19 to 22 November 1997, the International Centre for Theoretical Physics convened a meeting in Trieste to honour the memory of Professor Abdus Salam, one year after his death. Two and a half days of the meeting were devoted to physics, with lectures from his colleagues on recent developments in theoretical physics, while one entire day was reserved for his commemoration by friends, collaborators, Italian and international dignitaries and members of his family. On that day, 21 November, I had the privilege of announcing that henceforth, the Centre would be named

The Abdus Salam International Centre
for Theoretical Physics

following a decision of the Centre's Steering Committee, the Government of Italy, the United Nations Educational, Scientific and Cultural Organization (UNESCO) and the International Atomic Energy Agency (IAEA).

The Centre bears Abdus Salam's name because it was created by him and, through his vision and untiring efforts, achieved a high level of international excellence that promises to continue through the next century and beyond.

In this booklet, we publish the speeches presented on the Commemoration Day. We hope that, together with the scientific proceedings, they will be acknowledged as a modest token of our admiration for all the works of Abdus Salam and of our gratefulness for the magnificent legacy he has left to this and to future generations.

We wish to thank Katrina Danforth, Anne Gatti, Faheem Hussain and George Thompson as well as other members of the Centre's staff for their joint effort in organising this Memorial Meeting, and last but not least, all the members of Abdus Salam's family who were with us on this very special occasion.

M.A. Virasoro
Director of the Abdus Salam ICTP

Introduction

On 21 November 1997, the name of Abdus Salam, first Director and President of the International Centre for Theoretical Physics, became officially tied to that of his brain child founded in 1964. This significant and emblematic change was announced by M.A. Virasoro, the Director of the Centre since 1995, on the Commemoration Day during the Memorial Meeting held at the Centre from 19 to 22 November, one year after the passing away of Salam.

Abdus Salam was well known in the international scientific community. He is acclaimed as a hero and a model by the youth in the developing countries. Yet in the speeches presented in this booklet, in addition to expressions of admiration for his scientific achievements and of gratitude for his relentless efforts in promoting the advancement of science in the developing countries, there are new, unpublished stories highlighting some of his qualities and his way of doing things as a youngster, as a fresh academic and as a mature cosmopolitan personality, which complete the already rich portrait of the man.

The Commemoration Day was entirely devoted to reminiscences of people who have known Salam intimately. The meeting was opened by Miguel Virasoro. After welcoming the members of Salam's family and all the guests, especially those who had travelled from distant countries to share moments of meditation and remembrance, he officially announced the renaming of the Centre. During his address, he also read a message sent by the Prime Minister of Pakistan, Muhammad Nawaz Sharif, on this occasion.

The ceremony was divided into four sessions. The first of these was chaired by Giuseppe Furlan, Department of Theoretical Physics of the University of Trieste and Head of the Centre's programme of fellowships in Italian laboratories. Professor Furlan had been a collaborator of Abdus Salam since 1964. Though his main research interest was theoretical elementary particle physics, he organised several scientific projects in other areas such as non-conventional energy sources and physics of the environment. Like Furlan, the speakers in this session were all involved in the operation of the ICTP from its inception. Paolo Budinich, co-founder of the ICTP, and Luciano Bertocchi were former Deputy Directors; Luciano Fonda and GianCarlo Ghirardi were consultants to the Centre and in charge of many programmes; Nello Paver, representing President Luciano Maiani, has been responsible for the co-operation with the Italian National Institute of Nuclear Research; Sergio Fubini collaborated with Salam at CERN and, more recently, in trying to establish good scientific relations between physicists from the Middle-East and those from Europe and America; A.M. Hamende was a senior member of the Centre's staff.

Riazuddin from Pakistan chaired the second session. Like Abdus Salam, he was educated at Government College in Lahore and at Cambridge University, where he obtained his PhD. He is presently Director of the new National Centre for Physics at Quaid-i-Azam University, Islamabad. Until recently he was Professor at the Physics Department of King Fahd University of Petroleum and Minerals in Saudi Arabia, after having taught at Quaid-i-Azam University in Pakistan for many years. He is a fellow of several academies and has been honoured with many awards and medals. Three of the speakers in this session (Daniel Akyeampong, Robert Delbourgo and Gerhard Mack) were Abdus Salam's young collaborators when the Centre was still at its temporary seat at Piazza Oberdan. Two others (Gordon Feldman and R.P. Bambah) knew Salam during his student years and his early scientific career while the last speaker, John Ziman, who also read a message from his colleague Stig Lundqvist, is the physicist who launched the activities in condensed matter physics at the Centre.

During the third session, which was chaired by the Director of the Centre, M.A. Virasoro, eminent officials representing the Italian authorities and international organisations paid homage to the memory of Abdus Salam. President of Albania Rexhep Meidani, a frequent scientific visitor to the Centre, was the guest of honour. On the Italian side, the speakers were Gioacchino Fonti from the Ministry of the University and Scientific Research and Technology, Aniello Izzo from the Italian Treasury, Eugenio Campo from the Ministry of Foreign Affairs (representing Minister L. Dini), and Roberto Damiani, Vice-Mayor of Trieste. The international organisations represented were the Centre's sponsoring bodies — the IAEA with Director General Hans Blix and UNESCO with Adnan Badran, Deputy Director-General — and two institutions founded by Abdus Salam: the Third World Academy of Sciences with Executive Director Mohamed H.A. Hassan and the Third World Organization for Women in Science with President Lydia Makhubu.

Saeed Durrani from the School of Physics and Astronomy of the University of Birmingham chaired the last session. He too was educated at Government College Lahore and Cambridge University, where he met

Salam who was three years senior to him. One of his grand uncles happened to be the Principal of the Government Intermediate College at Jhang, also attended by Abdus Salam. The contributors to this session were mainly Salam's fellow countrymen: Munir Ahmad Khan, who helped him at the IAEA in Vienna during the sixties, and Pervez Hoodbhoy and Asghar Qadir from the Quaid-i-Azam University. Nigel Calder, the science writer who often collaborated with Salam, and Professor Nguyen Van Hieu, a distinguished scientist from Vietnam, also took part. The session ended with addresses from three members of Salam's family: his grandson Imran Saadi and his two sons Umar Salam and Ahmad Salam.

That evening, Gordon Fraser from CERN delivered the after-dinner speech, which is also included in this little book.

Some of the many invited personalities who were unable to attend the ceremony sent messages, which are also presented here. This is the case of Maurizio Iaccarino, Assistant Director-General for Natural Sciences of UNESCO, and three Latin American scientists: Victor Latorre from Peru, a former member of the ICTP Scientific Council; Sergio Mascarenhas from Brazil, one of the promoters of medical sciences at the Centre; and Igor Saavedra from Chile, one of the first Associate Members of the ICTP. Excerpts from a selection of letters from other scientists are also shown.

Some of the speakers provided us with a written text of their talk while other speeches were reproduced from the recording. To preserve the spontaneity and freshness of the speeches, no extensive editing was done.

A.M. Hamende

WELCOME ADDRESS

Miguel Angel Virasoro
Director
The Abdus Salam International Centre
for Theoretical Physics

I now open this important session of the Memorial Meeting. First, I would like to express on behalf of ICTP and myself our profound gratitude to those of you who have come from all over the world to honour Abdus Salam. I thank especially those who left their country without a president or ministry without a minister, because they have shown the extent to which they care for our founder and everything he stands for. I also thank the numerous representatives of the Italian government because their presence here, which bears witness to the Government's attention to the Centre, is a pledge to keep it alive and creative. I also wish to thank particularly Professor Adnan Badran from UNESCO and Dr. Hans Blix from the IAEA and, finally, to express our most heartfelt gratitude to the members of Professor Salam's family who accompany us and bring with them the warmth of those who were nearest to him.

First of all, the new announcement. As you can see, from now on, the Centre will have a new name, The Abdus Salam International Centre for Theoretical Physics, to remind us that the Centre is his creature, that it is the heritage he has left us, as much as the Weinberg-Salam theory in another context, as a living monument to his memory.

I would now like to read a message that has just arrived from the Prime Minister of the Islamic Republic of Pakistan. It is indeed very moving for us, who are in this particular place — the adoptive country of Professor Salam — that Pakistan, his native land, is also present here today through a message from the Prime Minister. It is a letter addressed to the Centre, and to myself, and it says:

"I am delighted to learn that the Steering Committee of the International Centre for Theoretical Physics, together with its major sponsors, namely the Government of Italy, the International Atomic Energy

Agency, and the United Nations Educational Scientific and Cultural Organization, have decided to rename this Centre as the Abdus Salam International Centre for Theoretical Physics.

"Renaming this highly prestigious Centre is not only an honour for the memory of Professor Salam but also for Pakistan. He was a scientist of world stature and built up this Centre over a period of three decades. We are proud of him as the only Nobel Laureate of Pakistan. As the Scientific Advisor to the President of Pakistan for eleven years he rendered invaluable services to his country. As Director of the ICTP, he served a cause, not only of the international physics community but also of the scientists of the Third World. He made outstanding contributions toward expanding the frontiers of human knowledge and promoting science and technology throughout the world. I am sure that the renaming of the Centre will be a source of great inspiration to the younger scientists everywhere. "

Signed: Muhammad Nawaz Sharif, Prime Minister of the Islamic Republic of Pakistan.

This session will be one of reminiscences and anecdotes from those who were near to Professor Salam in different periods of his life, those who knew him well. I am not one of them. Though my life has been profoundly marked by his life and by his projects (in particular, when I returned to Argentina), I only had sporadic contacts with him whenever I came to the Centre. However, I do have an anecdote, and I want to relate it to you because I think it is rather emblematic of his way of thinking.

In 1975, a period already full of threats in Argentina, I had fled from my home country and gone to Princeton. Many colleagues who were still in Argentina had learned that there was a school in oceanography here at the ICTP, and applied for acceptance. For some of them, participating in the course provided an opportunity to leave the country. I took part in that school at my own expense since I was coming from Princeton. One day, Professor Salam saw me in the corridor amidst other Argentineans and said immediately with his swift sense of humour: "Oh, Virasoro! Some people consider you as the second Higgs. They speak about you but they have serious doubts about your existence." Then I explained to him that I had been studying oceanography for some time. His reaction was instantaneous. He said: "Okay, you have switched to oceanography. Now you have to go around and say to everybody that this is the best thing to do." This meant I should turn to other subjects, to more applied fields and so forth. I had learned (and this was mentioned by Professor Sezgin) that it was very dangerous to be in the vicinity of Salam because he would always find something for you to do!

I have never been very good at selling bibles, not even at selling Mao's red book. I took Salam's advice, however, as part of my idealistic push, and I went ahead and tried to convert some people. With the first two scientists I spoke to, however, I met with complete failure. They were almost offended. So I stopped and went back to Professor Salam. He was not worried at all. He said immediately: "Oh, they are going to be extremely useful in something else in their own countries." And then at that moment I began to realise that in a sense, one has to interpret Professor Salam's thinking, one has to understand what he was meaning at that moment.

He was obviously very keen that research in some applied sciences be done in the developing countries. He laboured hard in this direction for a long time. But at the same time, he was very adamant that everyone should work in the field of his choice. And why? This is a very important aspect of his thinking that I would like to reflect upon, because it has to do with the role of the Centre, with the future of the Centre and also with the past of the Centre. It has to do with the many fights that Professor Salam and many of his collaborators had to face in trying to impose the idea of the Centre.

Professor Salam was absolutely convinced that one of the problems with people coming from developing countries is that the first thing they are deprived of is the right to their own dignity, to their own self-respect. And that is the first thing that has to be rebuilt. His point was, first of all, that we must treat these people as our absolute equals, as people with dignity, so that they are able and allowed to do whatever kind of physics their curiosity brings them to. You certainly know that this concept was opposed violently at the moment of the creation of the Centre. A delegate said: "Why a centre for theoretical physics for developing countries? Why shouldn't we give them something for agriculture? Why do you give them — the famous sentence — a Rolls Royce when what they need is a donkey cart?"

There are, I think, many answers to these questions. One of them is provided by my friend Professor Baghdadi, who took part in this battle. To some opponents of the project he said: "Who allows you to deny three quarters of mankind the right to learn about the stars?" And he convinced them. This is indeed a crucial aspect of the Centre.

In this Centre we defend the right of anyone who comes here to study any problem: the problem that is more challenging, the problem that is deeper, the problem that is more basic, because the right to knowledge should be identical for everybody. That is one of the lessons of this Centre, and the reason why Professor Salam has always insisted on excellence. When we organise a school in string theory or in condensed matter physics or in any field, we invite the best lecturers because we must offer the best to those who are coming from all of these countries so that they can share with us the joy of learning from the best people in the field.

Now, of course the story doesn't end here. Salam had an infinite number of facets and the more you study him, the more new aspects you find. He was also worried about the social responsibility of scientists. When I tried to learn about that, I remembered that we had in the house an extraordinary person, the memory of all of the thoughts of Professor Salam, Dr. Hamende. I went to him and I asked him what exactly Salam had said about this social responsibility. He told me that Salam had made two points.

One is that the scientist in the developing country should be an expert in at least two subjects, not one. He was expecting more, not less, from the people. He said that a scientist, for instance, should be an expert in string theory and he should also be an expert in some other field which is applicable to the situation in which he is living.

And the second point, which is more difficult to decipher, is that the scientist must learn to be a politician. We do have here today a few examples and we should be very proud of the fact that some have been able to make this big step, because we know that for scientists it is a very difficult step.

Professor Salam was also insisting, of course, on the importance of applied science. Yesterday we heard from Professor Mascarenhas about the importance he was giving to medical physics.

I have another anecdote about myself because though I did not have continuous contact with him, since I have been here, I have had a kind of virtual contact, to say it in a modern way. I could perhaps say that I hear voices, but this might be a bit dangerous on this occasion. So let me say I have virtual contact with him. This virtual contact consists of the following: I think about some new project and with my collaborators, we come up with a new idea. We decided, for example, that the new project next year will be a School on the Mathematics of Economics. So then I went to Dr. Hamende who said: "Oh yes, Professor Salam had organised a school on economics in such a year." I sent a letter to some of the professors, and one of them, Ken Arrow, replied “Yes, I remember a dinner with Professor Salam in Oxford where he mentioned this project to me." So you see that it is very difficult to innovate.

I must say that my situation is like that of the poor physicists of string theory. I do not have the problem of following one track; there is an infinite number of tracks that Salam has left. In any subject, field or direction you can choose, he has also done something or pushed something. So the problem is the selection of the vacuum, as they say in string theory. From this large number of tracks, which one should you choose? We are trying to follow the same line as Professor Salam in many ways.

First of all, we must maintain the level of excellence of the Centre. Believe me, I am finding the same bureaucrats, with exactly the same arguments, who say "Why that, why do you need that, why do you need research in the Centre, why do you need to get that person who is supposed to go to Cambridge, just take someone else, etc. etc." In fact, we are trying to establish these new fields which some of our theoretical physicists may find enticing or be interested in learning. In particular, for instance, for the school on economics, we intend to invite people who are already working in mathematics of economics of course, but we shall also reserve a large part of the participation for people who do not have any background in that field, but who are trained in some other field in theoretical physics or in mathematics. The same methodology will apply next year with the course on statistics, and every year we shall try to go into some kind of a new field in the same manner.

So you can see that the directions are all already written, as in the famous Borges library. Everything is already written in the thoughts of Salam. We have simply to choose the appropriate one and that is the direction in which we are going. We owe all of this to Professor Salam. At this moment, I would like to remember what is his first and perhaps most successful programme, the Associateship programme, and invite one of our associates, Carmen Nuñez, to present a memorial plaque for Professor Salam.

MIGUEL ANGEL VIRASORO has been the Director of the Abdus Salam International Centre for Theoretical Physics since June 1995. He was born in Buenos Aires, Argentina, in 1940. After completing his doctorate in physics at the University of Buenos Aires, he worked at the Weizmann Institute of Science in Israel and at the Universities of Wisconsin and California in the United States as a post-doctoral fellow from 1967 to 1971. He became Professor at the University of Buenos Aires in 1971. He has held the position of Professor of Physics at the University of Rome since 1982. From 1974 to 1980, Professor Virasoro worked at Conicet in Argentina, the Institute for Advanced Study in Princeton, the Ecole Normale

Supérieure in Paris, and at CERN. He was appointed Professor at the University of Lecce in 1981. Professor Virasoro has been honoured with many international awards. He has made fundamental contributions to statistical physics, field theory and complex systems. His recent research interests are in spin glasses and neural networks.

Carmen Nuñez

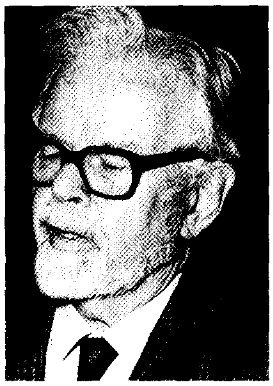
Associate of the Abdus Salam ICTP

The ICTP Associate Scheme allows us, scientists from and working in developing countries, to remain in contact with the more modern aspects of our own scientific fields through regular visits to the Centre. This programme is very important not only for our own research in our countries, but it also helps in developing scientific communities and scientific culture in our own countries. The Associate scientists of ICTP wish to honour the memory of Professor Salam and express their gratitude by donating a memorial plaque which they have bought. And on behalf of the Associates I would like to thank the secretaries of the Associates office and especially Anne Gatti, Professor Virasoro's secretary, for helping us to realise this project.

SESSION I

Chairman: Giuseppe Furlan

Paolo Budinich
Luciano Bertocchi
Luciano Fonda
GianCarlo Ghirardi
Nello Paver
André-Marie Hamende
Sergio Fubini



FULFILLED AND NOT YET REALISED DREAMS

Paolo Budinich
Professor Emeritus
of the University of Trieste
Former Deputy Director
of the ICTP

The establishment of the International Centre for Theoretical Physics (ICTP) at Trieste in 1964 and of the several international institutions which followed thereafter is due to a series of accidental but well correlated events. The first was Abdus Salam's participation, in June 1960, in one of the international symposia on elementary particles and field theory which we organised at the Castelletto of Miramare, and where he discussed SU(3) symmetry and renormalization. The second was his proposal, in September of the same year, at the General Conference of the International Atomic Energy Agency in Vienna, for the creation of an international centre for physics under the flag of the United Nations. I accidentally learned about it a few days later from Edoardo Amaldi in Rome. This early notice gave us the possibility of convincing our Government to immediately submit the Italian candidature of Trieste for such an institution. As a result of these happenings, after three years of difficult diplomatic battles which we, Italians, fought in Vienna together with Abdus Salam, the ICTP was inaugurated in Trieste in 1964 under his direction. Without that timing of events the ICTP would have been established elsewhere in Italy — in Florence or Naples — or otherwise in Copenhagen or in Vienna.

His scientific prestige, together with his drive and energy, determined the course of ICTP's history during the thirty years which followed. This has been a history of difficult battles which I have had the privilege of fighting with him. We obtained rewarding victories but also suffered from defeats which, more than the victories, contributed to generating and strengthening a deep friendship between us.

The best tribute to his memory which I can think of is to try to convey to you his and our dreams during those thirty years, especially those which have not fully come true as yet. I hope and I wish that, in order also to honour his memory, those dreams may be taken up as a commitment by those who now bear the responsibility of supporting this enterprise.

Since the first years of our operation for the benefit of scientists in developing countries — for the benefit of the poor as Abdus used to say — it clearly appeared that a lot could be done to remedy their isolation as well as the lack of consideration by local authorities, which were the main causes of the deleterious brain drain. However, the immensity of the problems, compared with the means at our disposal, became quickly apparent. At best we could produce a drop of benefit in a vast ocean of needs and difficulties. So much so that it was absolutely necessary not only to strengthen the ICTP, but also to replicate it, in other subjects, elsewhere. Salam convinced the United Nations Industrial Development Organisation (UNIDO) to copy ICTP for biotechnology. The result was the International Centre for Genetic Engineering and Biotechnology (ICGEB) which we finally succeeded in bringing to Trieste. Some replicas of the ICTP have been created in Colombia, Scotland, the US and recently, perhaps the best one, in Korea headed by C.N. Yang. But more are certainly needed.

When he visited the ICTP in the seventies, the Secretary General of the United Nations, U. Thant, took it as a model when he proposed and created the UN University which, despite our efforts to bring it not far from the ICTP, went to Tokyo (Japan offered 100 million dollars to host it there). Afterwards Salam tried to bring the Faculty of Science of the UN University to Trieste. This project was taken over by our Foreign Minister, who obtained the warm consensus of the UN University.

In addition to ICGEB, several other national and international scientific institutions were created in the Trieste area in the wake of the great success and prestige of the ICTP: among these, the Synchrotron Radiation Laboratory, the International School for Advanced Studies, the Research Area. Salam had hoped that their action would be co-ordinated and partially devoted to the benefit of the Third World. The UN University Faculty of Science could have served this purpose, and perhaps this project could still be revived.

In this framework he also conceived the creation of the International Centre for Science (ICS), run by UNIDO and devoted to high technology, new materials, earth sciences and environment, which should have developed its own experimental laboratories or others based in the existing scientific institutions in Trieste; but for the moment, the ICS, as conceived by him, is still at the stage of a project.

Salam's main concerns were actions in the framework of science and science literacy in the Third World, and the enhancement of South-South co-operation. To this end he created, through the Trieste International Foundation of which he was elected president, the Third World Academy of Sciences (TWAS), an instrument of very high prestige whose great potential has not yet been fully exploited. The Academy is privileged to have among its members several Nobel Laureates. I shall mention only one project of TWAS which Salam hoped to see implemented: the project of granting to each one of the developing countries at least one complete scientific library. He obtained a promise of support for this project from the World Bank. Now by means of computers, informatics and Internet which, I understand, ICTP is now developing and extending to the Third World, that project could perhaps be more easily realisable. It should be felt as a moral duty by the rich western civilisation which, after all, owes its birth to a library which was seated in a now developing country, that of Alexandria in Egypt. To start with, we proposed a pilot project for five Mediterranean countries to our government. We also obtained the interest of our President Scalfaro for this project, but for the moment we are only in a phase of promises and intentions.

I mentioned just some of Abdus Salam's dreams. There are other deserving ones which are illustrated in his book *Ideals and Realities*. I do hope that the concrete results of the action of ICTP after 33 years of operation will persuade the United Nations' agencies as well as our government to give the possibility to the Abdus Salam International Centre to make his dreams a reality for the benefit of those who need and deserve it. I am convinced that this would be the best possible way to honour Abdus Salam's memory.

PAOLO BUDINICH is Professor Emeritus of the University of Trieste. He is the *alter ego* of Abdus Salam. It is thanks to him that Trieste was selected as the seat of the ICTP in 1963. Professor Budinich was Salam's Deputy from 1964 to 1978. Since his retirement from the ICTP, he has founded and directed the International School for Advanced Studies, the Interdisciplinary Laboratory for Natural and Humanistic Sciences and the "Laboratorio dell'Immaginario Scientifico". He is an Associate Fellow of the Third World Academy of Sciences.

MY ASSOCIATION WITH ABDUS SALAM

Luciano Bertocchi
Former Deputy Director
of the ICTP

This is the story of my relations with Abdus Salam, which were quite close for almost thirty years, and very intense for the last twenty. The first time I heard the name of Salam was in the fall of 1956, when, as a young student, I was preparing my Italian Master thesis on dispersion relations. My supervisor gave me a copy of the lecture notes on dispersion relations which had been delivered by Salam at Rochester. These were hand-written notes — they appear in the list of his publications kept at our library as publication No. 24 — and the way they were written was very typical of Salam's approach and style.

Even for formulae, although the beginning as well as the final result were correct, the intermediate passages were full of mistakes; but the final result was right. This was typical of Salam: to be able to pick up, in physics as well as in all other domains, the most important points, and to look at them very carefully, neglecting the less important details, provided the final result was correct.

I met Salam for the first time only a few years later, on the occasion which has probably been the most important one for the scientific future of Trieste as the City of Science: the meeting organised by Paolo Budinich at the Castelletto of Miramare, with the participation of Salam; the photograph which was projected before by Professor Furlan refers to that meeting. (Six of these persons are with us today: Budinich, Fubini, Amati, Furlan, Tonin and myself.)

I later heard about the idea of the Centre during my stay at the University of Turin, from 1961 to 1963, and I vividly remember the lively discussions we had there on this subject, and the great interest with which the idea was received by the community of the young Italian theoretical physicists. We all clearly perceived how great this opportunity would be, not only for the developing countries, but also for the Italian physics community and for Italian science in general.

The existence of the Centre in Trieste was the main reason for my choosing Trieste University after my stay at CERN from 1965 to 1967, rather than returning to my alma mater, the University of Bologna. It was clear at that time that Trieste would offer, to a young theoretical physicist, better opportunities than any other Italian university.

The last twenty years are those in which my contacts with Salam were particularly intense. The way he recruited me was also an example of his behaviour. I had been given by Salam the task of organising one of the first training courses of the Centre. One day, Cal O'Neal, who was at that time our link with the Agency, came to my office while I was working on preparing the selection of the candidates. It was later evident that he had been sent there by Salam to examine my work. The report must have been positive, since immediately after I was offered the task of co-ordinating all the Centre's programmes and later the job of Deputy Director.

But afterwards Salam demonstrated his trust by delegating many responsibilities to me. His mode was: "This is what I want: find the way." What he required from managers was not to bend the rules; it was to find within the existing and applicable rules the way of realising what he had in mind.

The twenty years I have spent in close co-operation with Salam were the years of the Centre's development, when most of the present programmes were added to the initial schemes.

These were for us years in which we were co-operating closely, but also fighting each other; but those fights always ended in a clear mutual understanding. It was a period of hard work, of fascinating new projects but also of severe difficulties. We experienced great satisfaction, but also went through moments of deep frustration, when financial difficulties due to delays brought the Centre almost to collapse.

However, when Salam had to physically leave the Centre, those difficulties had been overcome, and he would be happy to see that now the Centre is a mature institution, which enjoys, to a large extent, stability and autonomy.

Salam was also a man of great humanity, although this aspect of him might have been hidden by his energy, by his will to do more and more and to request the same from those who were working for him.

He always dealt in the same way with heads of states and with the poorest and youngest scientists; we all remember him standing at the entrance of parties, shaking hands with all the individuals, from Nobel Laureates to young physicists. His favourite sentence was "no man is an island", meaning that we all have to co-operate.

To give you one example of his humanity, I will mention the following. A few years ago, a thief entered the villa where he was living and most of his medals were stolen. At the same time, they also entered the home of the caretaker, stealing his money. Salam's immediate preoccupation was to reimburse the caretaker what he had lost; and we had indeed to find a way within the rules to do exactly that.

What impressed me most about Salam were two aspects.

(1) The capacity of switching very rapidly, almost instantly, from scientific to managerial aspects, and especially vice versa, from managerial to scientific, always immediately identifying the key points.

(2) His great enthusiasm: his will to try, to explore new avenues, to launch new projects, even when he was not sure of success.

In physics, as well as in managing and creating new things, he always preferred to do 100 things, 10 of which were wrong, 80 right but normal, and 10 excellent, rather than carefully analysing a new idea before trying, and in this way avoiding failures by doing only 10 things, 9 of which were right and normal, and only one excellent.

Another aspect of Salam was his desire for learning. For him learning was as important as creating. I shall always remember one of the last discussions I had with him concerning physics, when his illness was already advanced.

He was asking me whether I knew a paper in which corrections to the semiclassical Wentzel-Kramers-Brillouin (WKB) approximation were discussed, since he felt that he would need higher corrections to semiclassical calculation in what he was doing at that moment in biophysics. Since we — Fubini, Furlan and myself — had written a paper on the subject about thirty years ago, I gave him a copy of that article. The day after he called me again, to discuss details in our paper. One day for him was more than enough, and by that time he already knew more about the subject than I did.

Among his great successes, two are the summits, and both now bear his name: the standard model in physics, the Salam-Weinberg model, and the creation of ICTP, the Abdus Salam International Centre for Theoretical Physics. I shall not list in detail the things he did not manage to achieve, but will just mention one: the creation of 20 new international centres to be located in the Third World.

I saw Salam for the last time in the Spring of 1995, when we visited him in Oxford. His body was no longer obeying his spirit, which was however still very vivid. When I was telling him about the Centre, his eyes were sparkling. And I will always remember him in this way: enthusiastic, and eager to learn and to do.

I shall end by saying that I consider myself fortunate, since I have had the opportunity of working for so many years in such close contact with a person like Salam. And many people here should also consider themselves as fortunate, for the same reason, as I do.

LUCIANO BERTOCCHI is Professor of Theoretical Physics at the University of Trieste. He was appointed as Deputy Director of the ICTP in 1983 and was Acting Director from 1994 to 1995. He retired in October 1997. Professor Bertocchi has co-operated with the Centre since 1967, first as scientific consultant and later as Head of Training Courses and Scientific Personnel. He has been a Visiting Professor in Norway and Argentina, a Scientific Consultant to CERN and DESY and rapporteur to many international conferences.

FROM THE ADVANCED SCHOOL FOR PHYSICS TO THE SYNCHROTRON

Luciano Fonda
President of the Faculty of Sciences
University of Trieste

Last summer, on 21 July 1998, Luciano Fonda suddenly passed away while sailing in Croatia. He was at the top of a brilliant academic career at the Faculty of Sciences — of which he was the President — of the University of Trieste but his mind was still full of projects. He has played a crucial role in the development of the Centre and, above all, in bringing the Synchrotron Laboratory to Trieste. He will be remembered not only for his outstanding scientific achievements but also for his great human qualities.

I met Abdus Salam in the summer of 1960 at Rochester where we were both attending the big Conference. I was still doing research in high energy physics at that time and, with him, I belonged to a small working party of physicists trying to understand the subtle world of particle physics. Feinberg, Gürsey, Marshak, Regge, Weinberg and a few others were also there. I was immediately impressed by Salam's deep insight into physical problems and by his promptness in jumping from one item under discussion to another.

However, it was four years later that he established a working relationship with me which quickly developed into a long standing friendship. He had appointed me as the first consultant of the Centre, in the field of nuclear physics, and consequently, there were many occasions for interaction when we were planning the organisation of that field of research. Moreover, Paolo Budinich had appointed me as Director of the Advanced School of Physics. The school was supported by the IAEA, UNESCO and the University of Trieste and welcomed fellow participants from developing countries. In this connection I gained a lot from his experience as a teacher at Imperial College for establishing the fundamental topics (bread and butter as he defined them) and the more specialised courses. The School remained in operation for fifteen years until its activities, courses and fellows were transferred to the newly born International School for Advanced Studies (SISSA). Throughout this long period my interactions with Abdus were continuous. Of course, we had some arguments since, because of stringency of funds, we were unable to cover the many fellowships that I wanted to have from the Centre but when he was wrong he would always write to his "brother", as he affectionately used to call me, a letter of apology, letters that I still keep because they bear witness to his kind-heartedness, to his great generosity.

Later, I had the chance to know him more deeply from a scientific point of view. It was the year 1974 and I received from the Nobel Committee, like other colleagues in our university, the request to propose a candidate for the Nobel Prize. I studied in detail all his papers which were related to the electroweak unification of forces and went directly to him to understand some subtle passages of the theory.

At the time I was surprised at his capacity to work and do research for hours and hours untiringly without vacations, with the only aim of reaching the final result, the final theory. I was also impressed by his sense of history. He had the reminiscence of the Islamic past civilisations and of the great Islamic philosophers imprinted in his bones. And then I became aware of his great humanity, of his donations to the poor without making himself conspicuous. As a matter of fact, few people know that with money he received from the prizes conferred upon him, he constituted a fund for donations of instrumentation to physics departments in developing countries. Together with John Strathdee, I was in charge of endorsing his cheques. These were extremely generous actions which he carried out without showing off.

In later years, starting from 1980, he strongly encouraged me to establish in Trieste a Synchrotron Radiation Laboratory. He provided me with actual help with some ministers, like Romita and Andreotti, and also spoke favourably of Trieste in England where I directly experienced the results of his action concerning the 6 GeV European machine that ended up in Grenoble. For the 2 GeV smaller machine of Elettra, now functioning on the Carso plateau, a few kilometres from here, he always pushed the idea that scientists from developing countries should have the possibility of doing research there and he proposed the construction of two beamlines at Elettra for their benefit. This is something which still has to be implemented. And again, in those circumstances, he was totally unselfish. In fact he told me that he was not afraid that the Italian Government would cut the Centre's funds when the project for building Elettra would have been approved. This was proven by the great joy with which he embraced me after the announcement I made in this very room on the 25th of July 1985 of the final decision taken by Minister Granelli on this matter.

I was really moved that day by his spontaneous gesture and I am moved today thinking that he is no longer here to spur us on with his vision in which poor scientists would benefit like the rich.

LUCIANO FONDA was Professor of Theoretical Physics at the University of Trieste. He has been closely associated with the ICTP since its beginnings. For many years he was Director of the IAEA-UNESCO-sponsored Advanced School of Physics of the University of Trieste and Consultant for nuclear physics and nuclear reactors. He was one of the main promoters of the project for the construction of the synchrotron radiation facility in Trieste. He was Vice-President of Sincrotrone Trieste at the time of his death.

ABDUS SALAM AND THE DEPARTMENT OF THEORETICAL PHYSICS

GianCarlo Ghirardi
Director
Department of Theoretical Physics
University of Trieste

For many years I have been in close contact with Professor Abdus Salam. I came to Trieste in 1963, and so I can say that I have been here throughout the whole period of his Directorship of the ICTP.

My relationships with him have been of at least three different kinds:

— Administrative. In the above period I have been the Director of the Institute and of the Department of Theoretical Physics of the University of Trieste for 13 years. Thus I had almost daily interactions with him concerning the collaboration between the ICTP and the University of Trieste. He has always valued enormously the presence of the University in the Miramare system and the tight scientific links between the two institutions. I think that all of us who belong to the University have to be grateful to him for his high esteem of ourselves and our institution.

— As a consultant. I have been the organiser and/or local organiser of many activities from 1976 to 1990. Seven years ago he asked me to head the Associateship and Federation Arrangement Programmes, a great honour for me, which allowed me to contribute to the attainment of the ideals of the Centre which I fully share. In relation with this direct involvement, I had the opportunity of witnessing day by day his commitment to running the ICTP in the best possible manner, his continuous desire to see the prestige and the absolutely peculiar and extremely useful role of the Centre, universally recognised among all scientific institutions of the world. The two programmes that he had launched had two purposes for him: on the one hand the primary purpose of fighting the isolation of young promising scientists in the developing world, and, on the other hand, to make the existence and relevance of the Centre adequately known in all countries in order to attract young scientists from the Third World. Consistently with these objectives, he also wanted to make the industrialised countries aware of the high scientific level and the relevant aims of this institution, in order to obtain the collaboration of prestigious scientists for the activities of the Centre, and to convince the governments of such countries to imitate the generosity of Italy in supporting this wonderful institution.

— As a scientist. I could say many things about this relationship. It has been extremely stimulating for me to interact with such a genius. But in place of celebrating his outstanding contributions to science which will surely be stressed by most of the speakers, let me tell you a story which testifies in an extremely significant way to his desire to give a very good image of the ICTP, his deep scientific insight and his open-mindedness.

As some of you may know, I have been deeply involved in investigations about the foundations of quantum mechanics for many years. Abdus had a good opinion of me but he was not particularly interested in this subject. He told me several times: "Do figures not come out all right when you use the theory — quantum mechanics — in its standard formulation, to calculate the outcomes of any actual experiment? Then, what are you worried about?" Such an attitude is perfectly understandable in his case: when, day by day, a genius like him is elaborating new fundamental concepts which lead to a radical improvement of our understanding of nature, he has to be extremely practical and concrete. The reflections, both mathematical and epistemological, will follow and will be the task of other people.

However, some years ago Sir Karl Popper, the world-wide known philosopher of science, was visiting the Centre. I remember Abdus calling me in his office and saying: "On this occasion I want you to make a long, incisive comment on the speech of Popper, so that it will be clear to everybody that at the Centre we have adequate competencies in all fields related to science." I knew the writings of Popper on quantum mechanics very well, and, with my deep respect for his philosophical work, I must say that I also knew very well that the ideas he was going to present in the seminar were not correct. Hence, I said to Salam: "I am ready to express my views, but I warn you that I shall be very critical about what he will say; I am a little worried about attacking such a famous thinker in public." Then Abdus replied: "You have no reason to be worried, I have full confidence in your competence, and you must go on." So, after Popper's talk I went to the blackboard and I proved, in the simplest and most direct way I could, why his proposal of a "gedanken" experiment, which would imply either the falsification of quantum mechanics or of special relativity, was basically wrong. He did not counter argue, he simply stated: "I am not very expert in the technical and formal aspects of the theory, but I remain convinced that if quantum mechanics is true, then you can send faster than light signals."

The following day Abdus called me and thanked me for my comments. He added that he also wanted to thank me for having made clear to him some interesting problems to which he had never paid attention. This is, among the recognitions I have received during my scientific career, one of those I value most. I have mentioned it only to highlight precise evidence of Abdus' desire to maintain the ICTP's prestigious image, his incredible capacity to grasp a subject immediately even if he was not familiar with it, and his open-mindedness which made him recognise that he could find something interesting even in a field which he viewed with a noteworthy amount of scepticism.

GIANCARLO GHIRARDI has been Professor of Quantum Mechanics at the University of Trieste since 1976 and is Director of the Department of Theoretical Physics of the same University. He has been a Consultant and Member of the Academic Board of the Centre since 1976, Head of the Associateship and Federation Arrangement Programmes since 1990, and he has organised numerous colleges at the ICTP. Foundations of quantum mechanics are his main research interest.

INFN AND THE CENTRE

Nello Paver
Director of the Trieste Section
of the Italian National Institute
of Nuclear Physics (INFN)
for
Luciano Maiani
President of INFN

With much regret, Professor Luciano Maiani, President of the Italian National Institute of Nuclear Physics (INFN), is not able to take part in this memorial ceremony. He has asked me to represent him and the INFN, and to address the meeting on his behalf. I feel honoured and privileged to carry out this pleasant function.

As physicists actively working in nuclear and particle physics, we owe Professor Salam his everlasting scientific work, which has been really influential for the progress of our field and has led to the present understanding of the subnuclear world. However, apart from his outstanding contributions in physics, I feel we should above all recall here other traits of his unique personality and, first of all, his contagious optimism as a rule of life. He was a very pleasant and social man, with surprisingly broad interests. He was genuinely concerned with the people, their activities, their way of life, their needs and so on. To add just one more recollection to the many others already presented here, in physics discussions or seminars he was always able to make quite pertinent — and often tough — points on the subject at issue, yet in such a polite and tolerant way that the interlocutor (or the speaker) in any case could feel at ease, even when the seminar had been tedious!

A passion for transferring scientific knowledge to the developing countries was a distinctive aspect of his whole life, and the creation of the International Centre for Theoretical Physics (ICTP) has been one of his greatest successes in this regard. Indeed, the winning and very original idea at the basis of this initiative was to counteract the "brain drain" from the developing to the industrialised countries by offering frequent and regular opportunities to deserving scientists from developing countries for visiting and working at a very stimulating research institution, the ICTP, in order to update their knowledge or to get training at a high level, on the understanding that they would return to their home institution after their visit and spend most of their time there. The stay at the ICTP would help them to remain competitive at the international research level as well as to enhance the quality of their teaching and, with time, to create or strengthen local research groups, acting in fact as agents for the transfer of science.

We are proud that the Italian Government was far-sighted and understood the potential of the idea, and that it decided to support the ICTP generously. The INFN collaborated informally with the Centre right from the beginnings. This collaboration was formalised later on through agreements covering participation in activities of common interest and exchange of scientists, which proved extremely rewarding over the years.

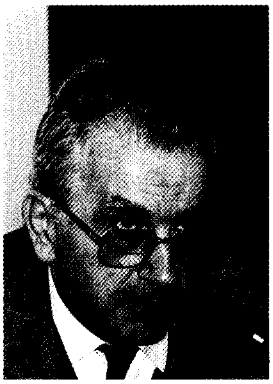
Another aspect of Professor Salam's personality I wish to recall is his faith in the role of the fundamental or basic sciences — which of course include theoretical physics and pure mathematics — in the development process. He obviously very well knew that social and economic progress depends on a multiplicity of factors including the mastery of "sciences in application", as he called them, and of high technology. In fact, he promoted many programmes pertaining to these categories at the ICTP. However, he considered that research in the basic sciences represented a great "added value" from the cultural point of view and an indispensable requisite for successful research work in applied sciences and technology in emerging societies as well as in the industrialised world. In these days when severe cuts affect budgets for basic sciences and when society seems (to me) to prefer immediate financial returns to intellectual and educational benefits, we certainly miss a strong and eloquent defender of fundamental science.

Professor Salam was also very interested in international problems and in the role of science in politics and society. He was surprisingly well-informed about what was going on around the world and had fine, and global, intuitions in this regard. In particular, the present status of science in the Islamic society occupied a special corner in his vision of the world. He liked to recall that seven or eight hundred years ago, the great centres of learning were the Arabic universities of Toledo and Cordoba in Spain, and others in Egypt, Syria and Afghanistan! He never failed to encourage scientists, heads of states and of governments from Muslim countries to remember their prestigious past in the history of philosophy and science — of which he had a profound knowledge — and to strive for a "renaissance" of science in their society in a spirit of peace and of collaboration with the other parts of the world.

We thus remember Professor Salam with greatest admiration and love. Perhaps the best way to honour his memory is to continue our scientific research and do it to the best of our possibilities, and eventually try to realise, in part at least, some of his great visions of science and life.

NELLO PAVER was born in 1942. He has been Professor of Nuclear Physics at the University of Trieste since 1986. He joined the Institute (now Department) of Theoretical Physics in 1969 as Associate Professor, and then directed that Department from 1990 to 1993. Since April 1997, he has been the Director of the Trieste Section of the INFN. Professor Paver's research interests include elementary particle physics, quantum field theory, symmetries and effective Lagrangians.

LUCIANO MAIANI has been Professor of Theoretical Physics at the University "La Sapienza" in Rome since 1984. Born in 1941, he graduated in Physics in Rome in 1964 and worked at the Universities of Florence and Harvard until he was called to teach theoretical physics at "La Sapienza" from 1976 to 1984. He has been President of the INFN since 1993 and President of the CERN Council since January 1997. In January 1999 Professor Maiani took up up the position of Director General of CERN. He is a member of several academies, and has served on numerous international scientific committees.



AT THE SERVICE OF A GREAT SCIENTIST AND ADMINISTRATOR

André-Marie Hamende
Former Senior Staff Member
of the ICTP

First of all, I wish to thank the organisers of the commemoration ceremony for this opportunity to pay homage to Abdus Salam, the man who has been my supervisor from 1964 to 1994.

Abdus Salam was a great physicist and a great science administrator. His exceptional merits in science were sanctioned by the Nobel Prize nearly twenty years ago while the institutions created by him in Trieste speak for his extraordinary abilities as an organiser. Since other guests will talk about his work in physics, I shall focus on only a few of the many episodes which, during my thirty-year association with him, have left a profound imprint in my memory because of their impact on the course of development of the Centre and on my professional life.

Abdus Salam was moved by a passionate zeal for physics and for the social and economic emancipation of the developing countries. He was of course aware that science was not everything in this context but he strongly believed that science had an essential role to play in the process of economic development and that, according to his own words, "science transfer must always accompany technology transfer". This conviction which transpires in many of his writings and which is at the root of all the institutions created by him in Trieste should not be considered as a naive *Weltanschauung* promoted by a specialist but rather as an expression of his irritation and impatience against what he perceived as an indifference or absence of vision in some of the political circles of the developing countries.

The first years of the existence of the ICTP were crucial for establishing its credibility and for dissipating the scepticism about its usefulness of some of the IAEA Member States. It was then that Abdus Salam could display his extraordinary capacity of mobilising the friendship and the competence of eminent scientists like A.O. Barut, C. Fronsdal, M.

Rosenbluth, R. Sagdeev, Nishijima and of creating a stimulating research atmosphere while pursuing his own work and supervising the research of a group of young and brilliant physicists from the Imperial College. As Professor Kibble mentioned in his lecture, the study of symmetry in elementary particles was very popular in those days and the ICTP made important contributions to this sector. This was also the time when eminent scientists like A. de-Shalit, C. Villi, S. Lundqvist, N. March, J. Ziman, F. Garcia-Moliner became involved in the enlightened guidance of the activities in nuclear and in condensed matter physics.

The first episode dates back to 1968 a few months before the Centre moved from its first home at Piazza Oberdan to this building. Abdus Salam and P. Budinich called me and told me that out of the three professional posts which had been necessary in the establishment phase, only one would be maintained and that I should therefore combine my present duties with administration. They said that every one should be polyvalent and able to carry out as many tasks as required by the organisation. Some time later, Abdus Salam added that he would reject any budget proposal where what he called "overheads", or the cost of the administrative and technical staff, maintenance, heating and air-conditioning and so forth, would exceed 25-30% of the total. This was very drastic indeed but indispensable for the survival of the ICTP, and implied very strict measures on the recruitment, proper grading and promotion of the administrative staff. On that day, I probably did not fully realise that we were at the beginning of a period of austerity and of very slow expansion which was to last until the second episode I wish to talk about that is the Nobel Prize. In fact this episode is the Big Event at the ICTP.

The Nobel Prize to Abdus Salam is definitely the milestone in the history of the ICTP. Many of us remember that day of October 1979 when Abdus Salam returned to Trieste after the announcement of the Prize and the enthusiasm as well as the expression of affection and admiration which welcomed him at the entrance of this building, in the city and in the community from the developing countries. In the months which followed, the University of Trieste conferred the diploma of honoris causa upon him, he was made honorary citizen of Trieste and was received by all the local authorities. This Prize was the long awaited recognition of Salam's outstanding achievements in physics and, as an indirect consequence, the acknowledgement of the validity of his ideas on international co-operation in science and of the usefulness of the ICTP. For the Centre, it meant a first leap in the financing of its programmes.

It took nearly a quarter of a century to give the Centre the profile we are now accustomed to: stable research groups, 40 to 50 high level meetings every year in a large range of subjects with computational support when required, a conspicuous number of Associates and federated institutes, external activities, research fellowships in Italian laboratories. A few figures show that the Nobel Prize was determinant for the expansion of the Centre. From 1970 to 1979, the increase in financial resources came mainly from the IAEA and UNESCO and allowed for an increase of activities (expressed in person/month) of about 3.5% every year. After the Nobel Prize until 1984, the average annual growth rate jumped to 9% thanks to increased contributions of the IAEA and the Italian Government. In 1987, the Italian Government became by far the biggest sponsor of the ICTP. All this was due to the capacity of Abdus Salam and his Deputies Paolo Budinich and Luciano Bertocchi to convince high-rank international officials, ministers of the Italian Government and members of the Parliament, local authorities and Ambassadors of the genuineness of their ideas, and, of course, to the support of the international community of scientists.

The third episode refers to a visit, in 1981 or 1982, of the Minister of Foreign Affairs during which the second quantum jump in the financing was announced in this lecture hall. Professor A. Zichichi who was accompanying Minister G. Andreotti said that the Ministry of Foreign Affairs of Italy had decided to raise its contribution to US$ 5 million. This was somewhat expected and, of course, most welcome but the surprise came immediately after when Minister Andreotti announced: "I am sorry to correct my friend Antonino, but the contribution will be 10 million." I shall never forget the smile of Abdus Salam, the incredulous face of Luciano Bertocchi who had turned to me and a thunder of applause which followed. This was the dawn of a new era for the ICTP which materialised in 1987.

Let me now say a few words on my first encounter with Abdus Salam. This happened in July 1962 on the occasion of the International Seminar on Theoretical Physics organised by him under the auspices of the IAEA in Miramare. The IAEA had sent me there to assist the Scientific Secretary, A. McReynolds, after a sequence of fortuitous circumstances. During the six weeks of the seminar, I spoke only two or three times to Abdus Salam but, much to my surprise, on the eve of my return to Vienna, he invited me to join him and two lecturers, Marcel Froissart and Abe Pais, for a dinner at the Hotel Riviera. At the end of the dinner, he told me: "Hamende, when the centre will be created, you will work with me. I shall write to Director General." This is how the course of my life changed radically. I joined the

ICTP two years later. At the seminar, I met P. Budinich, S. Fubini who was a lecturer and other friends who are here today: Harun-ar-Rashid, J. Nilsson, G. Furlan.

Abdus Salam was a very rich and generous personality. He was exacting for himself and with his collaborators. He succeeded in inculcating in the scientific and administrative staff a sense of mission to which everything was subordinated. To many of the scientists from the developing countries and particularly to those involved in the more fundamental disciplines of physics and mathematics, he advised to cultivate another subject of a more applied nature (the second string), to contribute to the dissemination of science at a popular level and to take an interest in the economic and social progress of their country. To the administrative and technical staff, he said that everything should be done so that the visitors would gain the utmost of their stay at the Centre and never waste their time in useless bureaucracy. As for myself, whenever he gave me instructions, he left me ample freedom in the execution. Here, I must mention a trait of his character. He was at times very impatient and each time he had been somewhat rude to me, he would send me a note of apologies accompanied by a small present. I must also mention that I have always been impressed by his "multitasking" capacity: he could switch from one subject to the other with the velocity of lightning.

I wish to conclude with an expression of personal gratitude to Abdus Salam and to the many people with whom I collaborated, with a special thought to the "old timers". With them, life was at times difficult but never boring! As one of the many members of the ICTP community, I thank the sponsoring agencies, IAEA and UNESCO, and the national and local authorities without which the dreams of Abdus Salam and Paolo Budinich would never have come true. And now, I wish Director Miguel Virasoro and his team all success in continuing and strengthening the heritage left to us by Abdus Salam.

ANDRE-MARIE HAMENDE was born in Belgium. After his studies in engineering and physics he worked at the Institut interuniversitaire des sciences nucléaires in Brussels, Belgium, and at the Centre d'études nucléaires at Saclay, France. He joined the International Atomic Energy Agency in 1961 from which he was seconded to the ICTP in 1964, that is right at the birth of the Centre. He remained in Trieste as Senior Administrative and Scientific Information Officer until his retirement in December 1990. Since then he collaborates with the ICTP and the Third World Academy of Sciences.

ABDUS SALAM AND THE EXPERIENCE OF MYSTERY

Sergio Fubini
University of Turin and
CERN Theory Division

I am deeply honoured to have been invited to speak in the memory of Abdus Salam, an outstanding scientist and a very great man.

After all the talks, it is very hard to say anything new about him. However, I still found something which is one of the elements of Abdus Salam's fame. I am referring to one of his books: *Ideals and Realities.* I read it three times and from this reading, learned a lot from Salam. For instance, about the scientist's sense of wonder for the beauty and for the symmetry of nature, he wrote the following which clearly characterises his way of thinking:

"Now if there is one hallmark of true science, if there is one perception that scientific knowledge heightens, it is the spirit of wonder; the deeper that one goes, the more profound one's insight, the more is one's sense of wonder increased. This sentiment was expressed in eloquent verse by Faiz Ahmad Faiz:

کئی بار اس کی خاطر ذرّے ذرّے کا جگر چیرا
مگر یہ چشمِ حیراں جس کی حیرانی نہیں جاتی

> Moved by the mystery it evokes, many a time have I dissected the heart of the smallest particle. But this eye of wonder; its wonder-sense is never assuaged."

In this context, Einstein, the most famous scientist of our century, has written: "The most beautiful experience we can have is of the mysterious. It is the fundamental emotion which stands at the cradle of ... true science. Whoever does not know it and can no longer wonder, no longer marvel, is as good as dead, and his eyes are dimmed. It was the experience of mystery — even if mixed with fear — that engendered religion. A knowledge of the existence of something we cannot penetrate, our perceptions of the profoundest reason and the most radiant beauty, which only in their most primitive forms are accessible to our minds — it is this knowledge and this emotion that constitute true religiosity; in this sense, and in this alone, I am a deeply religious man."

A point I wish to stress is that a very important way of honouring the memory of a great man is to continue and strengthen his work. An American folk song says: "His body is in the grave but his soul is marching on." So the spirit of Salam is still there and we have to follow it from where it is, first in this Centre which is his Centre, and in his successor, an outstanding scientist from Argentina. Salam's spirit is also in the new centre in Korea, in the new developments in Venice and in the Middle East and where we, in Turin and in Geneva, are trying to build up good scientific relations between the scientists of the Region and with American and European scientists.

To conclude, I wish to quote a sentence from Disraeli, the great British statesman, which Salam cited many times and which reads: "There is nothing stronger and more lasting than an idea whose time has come."

We are all grateful to Abdus Salam for having created ICTP, a centre of excellence of world science and peace. I wish his successor, Miguel Virasoro, all the success he deserves in leading and inspiring the Centre in the future.

SERGIO FUBINI is Professor of Theoretical Physics at the University of Turin and an Honourary Member of the CERN Theory Division. Formerly, he was Professor of Physics at the Massachusetts Institute of Technology and one of the scientific directors of CERN. His connections with Abdus Salam go back to almost half a century of friendship. At CERN, he and Salam, who was a member of the Scientific Policy Committee, collaborated in launching the very successful plan for CERN particle accelerators. Recently, Salam helped and encouraged Professor Fubini to promote scientific collaboration in the Middle East.

SESSION II

Chairman: Riazuddin

Daniel Akyeampong
Robert Delbourgo
Gordon Feldman
Gerhard Mack
Ram Prakash Bambah
John Ziman
Stig Lundqvist

ABDUS SALAM AND AFRICA

Daniel Akyeampong
Department of Mathematics
University of Ghana

Let me begin by first expressing my sincerest thanks to the organisers of this meeting for their kind invitation to participate in this historic function.

My thirty years of close association with Professor Abdus Salam began in October 1963 when I entered Imperial College of Science and Technology, London, initially to take the diploma coursework in mathematical physics before embarking on the PhD studies. Salam taught the class in group theory. His lectures were very popular and one had to go early to find a seat. Following my successful completion of the coursework in the summer of 1964, he invited me to his office one day, and told me about a new international centre for theoretical physics to be established in Trieste, Italy, which he was going to direct in the autumn of the same year, and the reason why he expected me to join him there. That was how in October 1964, Jimmy Boyce, Ray Rivers and myself became the first postgraduate students of Salam in Trieste, and so had the honour of joining the post doctorate colleagues Bob Delbourgo and John Strathdee to become members of the group that was christened by Ms. Jean Bouckley and Ms. Miriam Lewis as "the Salam Boys".

The first years of our stay in Trieste were indeed exciting; Salam had just proposed U(6,6) as a possible symmetry group of nature and all eyes were on the Centre. Salam worked hard to get the Centre known world-wide and we were naturally infected by his ceaseless dedication. We had our lunches together at the Mensa dei Ferrovieri with him at the table head, John and Ray at one side of the table and Bob and Jimmy on the other, with me deciding when to sit next to Ray or to Jimmy. These became physics working lunches — with paper napkins serving as writing equipment — and each session usually ended with several suggestions from Salam or Bob or John for us graduate students to pursue later. The excitement and enthusiasm Salam displayed were infectious; and later when I had the privilege to collaborate with Delbourgo, who was my unofficial supervisor, it became clear that he was indeed a chip off the old block.

An association with Professor Salam is really a life-long one. When in September 1966 I went to say good-bye, I thought that was going to be the last time I would see him. However, a few months after my arrival in Ghana, I received a letter from him informing me that I had been made an associate of the Centre.

As an associate, I spent three months at the Centre after nine months of teaching and research at home. I do remember very vividly the standard questions he would ask on each visit, when I showed up to report my presence. "Oh, you are here?" he would say. "How is Ghana? Have you found a place to live? Where is your office?" And then finally "What are you working on?" Then he would say "Strathdee and I have been working on this interesting problem. Why don't you see him for more details?" It was through the Associateship Scheme which was extended several times for me that I was able to maintain a close working relationship with him, and for that I shall be forever grateful.

My last meeting with him was in the summer of 1993 when I went to say good-bye to him at the end of a visit to the Centre. It was an emotional one with both of us embracing each other and not saying a word as if we knew that it was to be the final farewell. In November 1996, I heard on the BBC that he had joined the ancestors.

Professor Salam in his time played many parts on this world stage. But for us in Africa, he will be remembered, I am sure, for having made it possible for our citizens to continue to conduct research at a high level while at the same time contributing at home. His conviction was that since science is a shared heritage of mankind, all of mankind should participate fully in its creation. But this not being the case at present, he felt that the rest must help to facilitate the internationality of science, especially since, in Salam's words, "East and West, South and North have all equally participated in its creation in the past as, we hope, they will in the future." In all his efforts, he was inspired by the words of the English poet, John Donne, who he so often quoted:

> No man is an island entire of itself;
> every man is a piece of the continent,
> a part of the main.
> ...

Any man's death diminishes me,
because I am involved in mankind.
And therefore never send to know
for whom the bell tolls:
it tolls for thee.

The unequal opportunities which exist in the world of science engaged Salam's attention and he used his influence and prestige to try and correct the imbalance. The existence of the Centre shows how much can be done with determination and goodwill all around. Because of his own love for symmetry, it was his hope that the African scientist would bring into creative effect his own cultural emphasis on beauty, elegance and rhythm, just as other scientists are influenced in their work by their cultural traditions. This hope could be fulfilled given the continuing support of the Centre.

In its early operation, the number of African scientists at the Centre was low indeed. There were only two, Skyim-Kwandoh and myself, both from Ghana. We were to be joined later by Taha and Ahmed from Sudan, Maduemezia and Nwachuku from Nigeria and later still, when Condensed Matter Physics became one of the recognised programmes of the Centre, by Allotey from Ghana and Williams from Nigeria. The Centre has helped to sustain quite a sizeable number of active African mathematicians and scientists, many of whom unfortunately are no longer at home to train the next generation of scientists as envisaged by Professor Salam. These have joined the infamous brain drain — the tide that Salam strove so vigorously to stem — not because they wanted to, but because unfavourable socio-economic conditions so familiar to Salam made it difficult, if not impossible, for these scientists to be creatively productive in their own countries.

Was Professor Salam disappointed by this turn of events? Ever the optimist, Salam knew that the political and economic situations in our part of the world will take some time to improve. In the 1980's, a *coup d'état* brought to an abrupt end a Regional College organised by the Centre in an African country. Subsequently, when he was informed that another College being held in an African country had been abandoned, also because of a *coup*, Salam's immediate reaction was "Now I know how to export *coups d'état!*" These setbacks may plague the developing world into the near future, but that is no reason to prevent us from bringing some of the Centre's scientific activities nearer to home so that many more people will benefit from these collaborations.

Africa has indeed appreciated what Salam did for her sons and daughters, and this is evidenced by the number of honours bestowed on him by its academies — including the African Academy of Sciences; the Academy of the Kingdom of Morocco; the Ghana Academy of Arts and Sciences — and by the esteemed recognition of many of its universities — including Maiduguri in Nigeria; Khartoum in Sudan; Nairobi in Kenya; National University of Benin in Cotonou, Benin; University of Ekpoma, Nigeria; Yaounde, Cameroon; Ghana — and by the several audiences granted him by heads of state throughout Africa.

Salam has bequeathed to us knowledge and compassion. So what can we do to ensure that his dream, his ideal, shall never die? ICTP can contribute by continuing to make it possible for many more scientists from the developing countries to meet and exchange ideas with their peers here. And the international community at large can contribute by building other centres for highly trained researchers in other fields, and locating such facilities strategically to enhance their accessibility. Building bridges to ensure the universality of science will be a lasting monument to his memory.

But above all, it is the man's vision — which was his humanity — that I fervently hope the Centre will keep alive perpetually, like a flame.

DANIEL AFEDZI AKYEAMPONG is a distinguished academician from Ghana. He was one of Salam's students at Imperial College and was among the first group of students who came to Trieste in 1964 when the ICTP was just taking off. He did his PhD while the Centre was still at Piazza Oberdan. He returned to his homeland where he has held many important positions including that of Vice-Chancellor of his University.

TEACHER, COLLEAGUE AND FRIEND

Robert Delbourgo
Department of Physics
University of Tasmania
Australia

Firstly, I should like to say how privileged I feel at having been asked to address you today. Secondly, let me tell you that it was a heck of a long way to come for a 15 minute talk! In fact, after receiving the invitation, I initially hesitated until, upon reflection, I accepted as a way of rendering homage to the great man; in other words, I have viewed this visit as a "pilgrimage". Thirdly, I must confess that I have given other reminiscence-type talks: at Imperial College last February and at the SalamFest in Trieste in March 1993, which incidentally was the last time I saw him and which I found a rather moving experience, especially when he was awarded an honorary doctorate by St. Petersburg University. My contribution today will inevitably be a minor variant of those talks; my apologies therefore to those of you who have heard it all before.

Salam assumed many different roles in my life: initially as a teacher, both undergraduate and postgraduate, then as PhD supervisor, then as "boss" (here at ICTP) and finally as a good colleague and close friend. My first contact with him was as a teacher. Even though Salam did not relish lecturing, I found him to be one of my most inspiring teachers, his breakneck pace notwithstanding. And he mixed well with the students at Imperial. In fact my first contact with him was in 1958 when he came to a dinner where students got to know the staff. He wasn't too busy for that sort of thing and he always found time for students, that is until he got deeply involved in the business of founding the International Centre. Many of you will know that Salam was a totally unpretentious person. Curiously, he quite enjoyed English refectory food (can you imagine that?) and was at his happiest when mixing with the "plebeians" (as he called the student body) in contrast to the "patricians" (or staff). On one occasion Bruno Zumino was visiting us from CERN and Salam insisted on taking him for lunch to the student cafeteria rather than the Staff Common Room, as he preferred to rub shoulders with the "common man". I think this tells us something about his personality

Naturally, he was a great source of inspiration to the students who had somehow got wind of this brilliant, charismatic professor who had been recently recruited by Blackett and who inhabited the Huxley Building. It was the basic reason why I chose to study theoretical physics at Imperial, under his tutelage. It was also the reason why hordes of Pakistani students flocked to Imperial College; indeed they represented a good third of the postgraduate intake. The early sixties were the days of spontaneous symmetry breaking, compositeness conditions, the gauge technique and of the birth of flavour SU(3). I vividly remember the verbal slanging matches between Salam and Ne'eman during the early exploration of the eight-fold way. You must realise that Salam was a formidable taskmaster and not many persons survived his scrutiny: he was ever impatient for quick progress and his fertile mind kept on exploring new avenues or angles — far too disconcerting for a budding postgraduate as Mike Duff mentioned yesterday. Each day he would come into my room, rub his hands together and inquire if the problem was "all done", even though the calculations could be pretty gruesome. With Salam you either learned to swim well or else you sank: no snorkelling allowed. All things considered, I am really grateful to him for shaping my character and giving me experience in handling people, most of all Salam himself. When standing up to argue with him on one of the finer points of a problem, you had to be pretty darn sure of what you said because he had a wonderful intuition about the answer and was much more often right than wrong. When out of desperation you would confront him and ask him how could he be so certain, he would break into one of his wicked smiles, twiddle his thumbs, lean back in his chair, raise his finger and point upwards. Mind you, if you stood your ground and (on the odd occasion) turned out to be correct, he did respect you for it. On the other hand, Salam would not tolerate pedantry; he was often scathing of persons who did not measure up to his high standards, referring to them as "tom-tits" or "broken reeds"; those epithets were more derogatory than being labelled a "youth" or "young so and so".

Let me reminisce with you about the early days of the Centre. It started life in the top two floors of the social security building in Piazza Oberdan, as a few of you here will remember. It was, and still is, quite an imposing edifice, wonderfully located in the heart of town. Salam was determined that his vision of a successful centre in theoretical physics would succeed and he devoted countless time and boundless energy to attaining that goal, ably aided and abetted by Paolo Budinich and Luciano Fonda. The first full year of operation, 1964, saw a constant stream of visitors coming for workshops in many different fields, but principally in high energy physics. A few of the more permanent early residents were Fronsdal, Barut, Oberman, Sagdeev, Giambiagi, Janouch, Werle, Niederle and last but not least my good mate John Strathdee. As well, Salam brought in a number of students from Imperial College, among them were Daniel Akyeampong (who kicked off this session), Jimmy Boyce and Ray Rivers. It is no reflection on Salam that he could be a bit irascible at times, for he was under great strain trying to keep the Centre financially buoyant and academically vibrant. He spent so much of his time coaxing or otherwise shaming the politicians into supporting the Centre, activities which distracted him from his true love, namely research. I remember one occasion, with some amusement, when all the delegates from various countries voted "yes" on some motion which affected the operations of the Centre; all except for Australia. This annoyed Salam intensely and ever after I detected traces of anti-Australianism. I said "with some amusement" because in today's climate the Australian Government is anxious to foster international links, so it would be a very different vote nowadays and Salam would have found other enemies.

The administrative staff which Salam had recruited from the IAEA included Moira Blessington, Jean Bouckley, Miriam Lewis and André Hamende. They provided every assistance to the scientists and even developed some of their quirks. I wonder how many of you recall the hilarious 1st of April pre-prints that Miriam Lewis used to issue, which contained the latest jargon. They are probably lodged in the archives. If any of you are feeling blue about the progress of your research, I recommend that you read them; they will clear up the cobwebs and put your efforts into perspective. ICTP was a cosy outfit those days and there was a tremendous *esprit de corps*, which no doubt still continues today, although ICTP is a much vaster entity. Salam's hyperactive life took him to all corners of the globe, mustering support for the Centre and generally showing the flag. It meant that he came only in short bursts to Trieste. Often the only times John Strathdee and I could discuss the finer points of relativistic SU(6) with him would be an hour or so before or after his plane flight. The rumour that he did much of his research in transit or upon an aircraft is not particularly far-fetched. Because he was so often abroad, it was sometimes left for John and I to entertain the occasional visitor who came for brief spells to ICTP. I shall never forget the day that we took the venerable old scientist, Oskar Klein, out to lunch on the Carso plateau; I only mention this fact because Klein, like Dirac, was a real hero in Salam's eyes and regarded by him as the real discoverer of SU(3) flavour symmetry.

Salam was a model Director and took great pains in getting to know and welcoming anyone who worked in the Centre. He mucked in with everybody and lunch at the Mensa dei Ferrovieri near Piazza Oberdan was one of his favourite meeting spots. At weekends he loved going out for a meal of grilled fish at one of the numerous restaurants along the Strada Costiera. There was one in particular near Sistiana which caught his fancy — I don't know if that trattoria is still there? Being impatient to get back to work, he had a mischievous way of gaining immediate attention from the waiters at the end of the meal if they delayed too long in writing out "il conto": he would just get up and leave! You should have seen the waiters scurrying to write out the meal ticket.

Anyhow, those first two or three years, until the success of the Centre was assured, placed a considerable toll on Salam's health and nerves. But in all that time his research activity remained feverish. I feel so honoured to have had the opportunity to collaborate with him. Also, I owe him a great debt of gratitude, not only for offering me the job at ICTP but for conjuring a lecturing position for me at Imperial College in 1966, upon the death of my father, and with Paul Matthews' active connivance. We continued working happily together for many years until Tasmania beckoned me in 1976. To impress upon you his energy and vitality, there was one year (1968 as I recall) when he suddenly contracted appendicitis and went into hospital of course for surgery. At visiting hours, a mere two days after the operation, he was already talking animatedly about physics. This gives us another insight into his character: mentally, he felt anxious to keep abreast of progress and not miss anything of importance.

Salam remained in contact with me for a while after I emigrated and he always took genuine interest in my family, as he did with everyone whom he nurtured. He influenced my life at crucial stages in so many significant ways that I miss him greatly, as surely do the present company. I will always treasure my memories of his kindness, his sense of adventure and the fun of physics — who can ever forget his infectious laughter — his generosity, his friendship and his humanity.

The organisers of this session instructed me to limit the talk to a quarter of an hour or less, so let me stop now and pass the baton on to Gordon Feldman.

ROBERT DELBOURGO is Professor of Theoretical Physics at the University of Tasmania. He studied at Imperial College, London, where he obtained his PhD under the supervision of Salam. He joined the ICTP in 1964, became a lecturer at Imperial College in 1966 and moved to Australia in 1976. With Salam, he co-authored about thirty papers, principally in the area of higher symmetries and their breaking.

FUN WITH ABDUS SALAM

Gordon Feldman
Johns Hopkins University
United States of America

We have heard and will hear a lot about Abdus as a first-rate physicist, as a world-class leader, as a great mentor for many younger people and all of the other attributes that went into making him a unique individual — only one of a kind. I would like to talk to you more about the way I knew him as a fun loving, happy person who could always make the sun shine for the friends around him.

At the same time, being here in Trieste gives me the opportunity to remind many of you that the early seeds of the Trieste centre were planted here in 1960 at a small intimate meeting held at Miramare Castle and organised by Professors Budinich and Villi. Abdus and I attended from Imperial College. We had a hilarious train ride from London to Trieste in which he presented himself as an Eastern potentate and I was his white factotum (always walking at least three paces behind him). I don't think we were very successful in the pretence. Travelling 3rd class could not have helped the image! And the meeting in Trieste was a joy. I would like to read a few lines from a small article in which we wrote about the meeting for *Physics Today*.

"In the letter of invitation the following appeared: 'The purpose of the Symposium is to satisfy a pressing need for continuous interchange of ideas on fundamental physics and to offer an ample opportunity for discussions. In keeping with its objective, the atmosphere of the Symposium will be very informal.' This purpose was admirably carried out. The writers have attended few conferences so enjoyable and at the same time so informative. The large international conferences somehow engender a type of 'conference tension' which was noticeably lacking at Trieste. Instead there was genuine relaxation, as well as good physics."

After describing the formal sessions we go on to say: "The informal sessions were held on the beach, at the table, and near the bar. The discussions were not always on physics. It is difficult to convey in a short article the impression this conference left on the conferees. Perhaps it is best described as one of pure delight."

And pure delight is what it was like being anywhere with Abdus.

I still remember the first occasion when I met him. It was in the summer of 1952 when he came to the University of Birmingham (then the domain of Rudolph Peierls) to work with Paul Matthews. I was Paul's graduate student. The sparkle in Abdus' eyes and the excitement he engendered were contagious. And he and Paul were a perfect match as collaborators and close friends, which they remained throughout their lives. For the next few years I would see Abdus again at Birmingham or at conferences, but it wasn't until after he and Paul moved to Imperial College in 1957 that our friendship grew. From 1959 to 1975 I spent every third year at Imperial on sabbatical or leave from Johns Hopkins. I was also there most of the summers in between. Those were happy times. I shared an office with Paul, and Abdus' office was either next to ours or just across the hall. Although I did collaborate on a couple of (forgettable) publications with him, most of our interactions involved just talking about physics and the world in general, usually in our offices or at lunch at Saroya's. The days were always enjoyable and full of laughter. Abdus, as most of you know, was constantly full of ideas and he was always bursting into our office to expound some new proposition or idea. Since I wasn't always receptive to them he dubbed me (affectionately I think) "the pisser". Of course there were so many of these ideas that, statistically, I had some chance of being right. Both he and Paul loved to give names to expressions or equations (some of them a bit risqué) and then tried to get them past the editor when an article was submitted for publication. I remember when they submitted their paper on functional integration (where they nearly got the integration over Fermi fields right), Abdus was so pleased with what we now call the generating function — from which all other quantities, Green's functions etc. follow — that they dubbed it something which I cannot repeat at a public talk but which those of you who know your ribald poetry may recognise. However it did not get past the editor!

Abdus was not only excited about his own ideas but also excited when he read about something he had not known before and thought was simply beautiful. I remember his bursting into the office once and on the blackboard he drew a short line segment with two little circles attached to the ends and with his eyes glowing with excitement he said "that's SU(3)". Needless to say, neither Paul nor I had a clue as to what he was talking about. Abdus had just started reading the works of Dynkin and although he couldn't answer any of our halting questions he knew the work was very significant and his joy was infectious. I could go on with many more such episodes which filled the days with joy, happiness and laughter.

Finally, in a change of pace, I would like to show you a copy of a newspaper article which Abdus sent me soon after my 1974-75 sabbatical at Imperial. It appeared in a Swedish newspaper just one day before the 1975 Nobel Prize in Physics was announced. Perhaps not everyone reads Swedish fluently so (with the help of a Danish colleague in Baltimore) I will translate the large print.

"A rapidly growing group of Swedish physicists appear to be moving towards the belief that the Pakistani born physicist Abdus Salam, for the time being active in Trieste and London, and his American colleague Steven Weinberg, and possibly others as well, will share a Nobel Prize in Physics. In which year such an award would occur naturally remains highly uncertain. One possibility is this coming Friday when the scientific academy will decide this year's Nobel Prizes in Physics and Chemistry."

For those of you who keep track of Nobel Prize winners, you may remember that in the year 1975 the Physics prize was awarded to A. Bohr, B. Mottelson and J. Rainwater.

There is also the first paragraph of the article which says: "Salam who is 50, and Weinberg, 42, are both theoretical physicists, the former (Salam) is considered the modern day Einstein."

That to me is a fitting tribute to a great man and a great friend.

GORDON FELDMAN is Professor of Physics at John Hopkins University, USA. He met Abdus Salam for the first time at the University of Birmingham in 1952. At that time, he was a graduate student working with P.T. Matthews. When Salam and Matthews joined Imperial College, he became a frequent visitor of that institution during the period 1959-1975. Several papers are co-authored by these three physicists.

WHAT I LEARNED FROM ABDUS SALAM

Gerhard Mack
Institute for Theoretical Physics
University of Hamburg
Germany

It is really a privilege to be here today and to speak a few words in memory of Abdus Salam. But before starting with memories, I should tell of the very warm feelings in my heart at seeing so many friends again who are here today in this commemoration of Abdus Salam, friends who were here in 1968 and during the summers of 1969 and 1970. That was nearly thirty years ago and I haven't seen some of them since. Daniel Akyeampong was one of them and he mentioned in his talk the name of several others and so did Bob Delbourgo. There were scientists from all over the world, from all the continents, from Africa, many from Latin America, from India, from Pakistan, and from other countries. This is a tribute to the significance of the work of Abdus Salam that, through the creation of this Centre, made it possible for people from so many countries to become friends. This is undoubtedly a very important achievement.

There were not only scientists, there was also the staff and I am glad that Miriam Lewis is here. She was the head of the publications department, and the first who gave me an introduction to how things were run at the Centre. She did it in her own peculiar way with her own special British sense of humour; with a totally straight face she told me the most incredible things about chain gangs being here working day and night and let out to the air once a week on Sunday morning!

When I was here in 1968 I never felt any pressure or any stress. Part of that privilege might be due to the fact that I never worked on SU(6) or $\tilde{U}$ (12) symmetries that seem to be remembered very strongly by a few of my colleagues. In fact I had brought with me my own group SO(4,2): 4 and 2 is also 6 but nevertheless it was a different story!

I was a young man then and one of the kind who does not have his feet very firmly on the ground, I should say. Abdus Salam seemed to like me and anyway I got quite close to him during the time of our collaboration. I learned a lot from him about physics and two main things in particular. The first was the importance of gauge theory. I think it is still more important than anybody thinks even now. He sent me to the library to learn about it, reading papers of Yang and Mills, of Higgs, of Kibble, and so on.

The second thing was on the use of mathematics. Now I think that this is a very good lesson also for today. Those who know string theory will understand what I mean. His message was that you should keep your attachment to mathematics to whatever is necessary for physics and if you had the right physics intuition then you could easily learn the mathematics that you needed. He told me with some glee that he didn't know any group theory but learned what he needed. When he was at Princeton and presented a talk on $\tilde{U}(12)$, Eugene Wigner asked him whether this was a compact or a non-compact group. His answer was more or less that he didn't care so long as he knew what the physics of it was. The lesson from this story was that you would find the right mathematics in due time when you encountered the proper physical difficulties.

But there were also many informal chats on various subjects. Among other things, he tried to put my feet a little more firmly on the ground by telling me of the money needed to run a physics centre and how he went about getting it. I learned to know him as a very warm-hearted person when, unfortunately, my father had a bad accident in Germany and I had to leave; he sent me home right away.

The most important message and insight I got from him was one which some of us have mentioned before — of a political nature really. The essence of this message was that the people, especially the people of the developing countries, should be given a sense of dignity. This is, I think, the heritage which is important. Let me therefore say a few words of my own on that.

We all know how conflicts arise when people are deprived of the sense of their worth and dignity; how politicians use that in order to gain support by polarising the society, making one part of the society look down upon the people in the other part. You can always find a difference and any kind of difference is transmuted into a difference of worth. Many of the worst things that have happened in this century have arisen in this way and the war in Bosnia is one of them. But we also know that the converse can happen. It grows out of hope. There was hope for some time. Let us hope that this not going to be destroyed completely, that the conflict in the Middle

East that seemed totally insoluble can be solved after all. The one real important reason behind this hope is that a sense of dignity has been given back to the Palestinian people.

The importance of the Centre did not concern the Third World only. There were also the people from Eastern Europe and since none of the speakers here today comes from the East, let me testify to that. In 1968 I met here in Trieste Ivan Todorov, from Bulgaria, and this started a collaboration of 25 years. When I met him, Ivan told me that this was his very first visit to the West. He had been in Dubna for 11 years before this visit. Even after that, for many years, it was far easier for scientists from the Eastern countries, including Yugoslavia, to come here than to go anywhere else in the West. Therefore, I believe that Trieste has played an essential role in maintaining very strong and intensive personal relations between physicists of the West and their colleagues from the Socialist countries, even during the cold war. There was one exception however: I never met people here from the former German Democratic Republic.

I think that the heritage of Abdus Salam, the heritage of giving dignity to the people, should be kept up, and I am glad that the new director Professor Virasoro mentioned it in his speech. After the Nobel Prize was conferred upon him, Abdus Salam told me once: "I don't need this prize for myself, I need it for the people of the developing countries. I need it for doing something for them." This was in the eighties.

The last time I had a scientific discussion with him was when he was already very ill, a few months before the SalamFest which took place here. We were standing in front of the elevator, certainly at least for ten or fifteen minutes. He told me of his interest in biology and we talked about physics. It was difficult to understand what he said. I had to get my ear close to his mouth. Nevertheless, he was still full of enthusiasm. This is how I remember him.

GERHARD MACK is Professor of Physics at the University of Hamburg, Germany. His PhD thesis on scale and conformal symmetry presented at the University of Bern, Switzerland, called the attention of Abdus Salam who invited him to work for nine months at the ICTP in 1968. While in Trieste, he and Abdus Salam published an important paper which is included in the *Selected Papers of Abdus Salam.*

TOGETHER IN LAHORE AND CAMBRIDGE

Ram Prakash Bambah
Professor Emeritus of Mathematics
Punjab University, India

I am very grateful to the organisers of this meeting for giving me this opportunity to pay homage to an old friend, a great friend, a kind friend.

For a long time before the independence of India and Pakistan in 1947, Panjab University at Lahore had the responsibility for supervising and co-ordinating higher education in a large part of North-western India. This part consisted of the present Pakistan (minus the province of Sindh) and the Indian states of Jammu and Kashmir, Himachal Pradesh, Punjab, Haryana and Union Territory of Chandigarh. Part of this responsibility was to hold the final school examination, called the MSLC or Matriculation and School Leaving Certificate examination. In the Spring of 1940, the results of the MSLC for that year were announced, and they carried the stunning report that a 14 year-old boy, from a remote place called Jhang, had not only topped in the examination, but he had also obtained a much larger score than all the previous ones. All earlier records had been broken by a great margin. The next day the regional leading newspaper *Tribune*, with which I now have the privilege of being associated as one of its trustees, carried the picture of a small boy with a large turban. The turban that you saw Salam wearing at the Nobel Prize ceremony is similar to the one he wore in March 1940. And that is the picture that I carry of Salam as I saw him for the first time.

With that kind of performance, he would normally have come to Government College, Lahore, for further studies. But due to lack of funds, or perhaps other reasons, he continued his studies at Jhang in a small college not known for its greatness. After two years he took the next university examination called the intermediate examination in the Faculty of Arts. He again got the top score.

In 1942, at the age of sixteen, he moved to Government College, Lahore. I had joined Government College in 1939 after my matriculation and at that time I was in the class one year senior to the class that Salam came to. That is where we first met in 1942. We were both sixteen. Government College was a leading institution in that area, but it was more of a public school than a university department, and it catered really to rich and influential people. They, however, took some good students and some sportsmen also to give it a certain character. The student body thus consisted of various groups of people with similar backgrounds. One such group was composed of those who had done well in examinations and Salam naturally found his place in this group.

This group had a subgroup including those who had topped in various examinations and Salam became a leading member of this subgroup. Soon after Salam joined us, one of us, Prem Luthar, got an attack of appendicitis and had to be rushed to the hospital. Salam looked up everything about appendicitis in the Encyclopaedia Brittanica and went to Prem's bedside to help nurse him. In the system, then and now, the hospital did rely on attention from friends and relatives to see people through their illness there. Salam spent 48 sleepless hours attending to Prem after his surgery. This endeared him to all of us and made him a very close member of the group. Also his laughter, such vigorous laughter in a small body, made sure that wherever Salam was, there was a lot of friendship.

The academic requirements were no strain on Salam, so he had plenty of free time. He discovered chess, which he started playing fairly well. He tried ping-pong, which he didn't play well. Then he started participating in debates, and spent more time in so-called frivolous activities than in study. I believe his father came to know of this and asked him to be careful so that his studies did not suffer.

Government College, Lahore, had no pretensions of great scholarship, but among the four teachers of mathematics there was a "strange" man called Chowla (whom perhaps many of you know as one of the great number theorists of present times), who was not only, perhaps, the only practising mathematician in the region, but he did mathematics all the time and nothing else. The other teachers used to think he was crazy. He had the habit of ending his classes sometimes posing unsolved problems. So, while teaching cubic and quartic equations to Salam's class, he posed a problem of Ramanujan regarding four simultaneous equations in four variables. Salam spent three or four days on that, and then he came back to Professor Chowla with the solution that the four variables were the roots of a quartic whose coefficients could be found by solving a cubic. Professor Chowla sent Salam's solution to *Mathematics Student* for publication. Thus, the first published paper of Salam appeared as a two-page note in volume 11 (1944) of *Mathematics Student*, pages 50 - 51. The note has at the end the name and address of the author as Abdus Salam, 4th year student, Government College, Lahore. He was an eighteen-year-old undergraduate at the time in an atmosphere where no one (other than Chowla, of course) thought of doing anything original. The last paragraph in the paper says: "By employing the same methods, we can solve the system of equations $x^2 = a+y$, $y^2 = a+z$, $z^2 = a+x$ much more rapidly than Ramanujan did. His is a very laborious method." One cannot but notice the confidence of an undergraduate student talking about an effort of the legendary Ramanujan. Unfortunately, I cannot show the paper here, but it can be seen in Salam's collected works.

In 1944 Salam took the BA examination with Mathematics, English and Urdu as his subjects. Once again, he broke all previous records by a large margin, actually more than 5 percent. He offered additional papers for an Honours degree in English and here again he created a new record, hurting the ego of some persons who, perhaps, played a somewhat negative role in Salam's career later, but I won't dwell on that. As a result of his performance in the BA in 1944, Salam faced a dilemma: should he go in for a Mathematics Master or should he opt for a Master's degree in English. He was equally good in both and had done extremely well. He had a great commitment to his family and to his community. He was conscious that the decision which he made should be acceptable both to his father and to the Ahmadiyya community, of which both he and his father were very devoted members. He decided to consult Mirza Sahib of Qadian, the spiritual leader of the Ahmadiyyas. Mirza Sahib advised him: "You can do whatever you want, but you must remember that you have to get into the Indian Civil Service (ICS)." The Indian Civil Service was the most important part of the ruling imperial system, and had a lot of power. It was expected that Salam with his brilliance would get in (the Indian Civil Service, after a stiff competition, used to induct four or five Indians every year in this elite service). Getting into the ICS was the hallmark of excellence and a road to sharing in the imperial power.

Salam opted for mathematics. I guess he felt that he could prepare English and History at the ICS level on his own, but Mathematics would need more training. Since I was one year ahead of him as a student of

Mathematics, we became closer still. In the meantime I had also moved to the hostel, so we were neighbours. Neither of us could afford to buy books, so we borrowed them from the library on the clear understanding that each of us could walk into the other's room and take whatever he needed to study. We exchanged some notes sometimes, but since the system was no strain, neither needed the other's help academically. Salam's interest in literature continued and he had a great passion for the beauty of thought, expression and also human form. He discovered Oscar Wilde and for some time he was talking only of the beauty of Oscar Wilde's language and wit. At one time he was reading Lawrence's *Seven Pillars of Wisdom*, a few pages almost every day.

In 1946 he passed his MA examination, again standing first with a high score. And then the dilemma started. The Indian Civil Service examination allowed you to get in and help the community through the power that came that way. But the examination had been suspended in 1942 during the war and had not been restarted. Also, even if the examination had been restarted, Salam would have been too young to take the examination and he would have had to wait a couple of years before doing so. So it was decided that he would spend a couple of years in England. I think again the feeling was that maybe he should take the English part of the ICS examination which would make it certain that he would get in. By a fortunate combination of circumstances, he got a scholarship for which he was barely qualified because it was meant for farmer's sons. His father had acquired a piece of land, and, by a very liberal interpretation of the word farmer, he was declared to be one. Then there was the question of obtaining admission. The biggest worry was to get to England in time for the academic session. At that time the war had just ended and the very few boats that were available sailed after long intervals. Berths were difficult to get. Due to a cancellation he was able to secure a place in a boat that got him to Cambridge just in time to join St. John's College in the autumn of 1946.

At the beginning of 1948 he passed the Mathematical Tripos Part II with a first. It was rumoured that he had the top score there also, though at Cambridge they did not reveal individual scores. I came to Cambridge in 1948 as a research student and met Salam again. On his advice, with the help of Professor Mordell, my supervisor, I also transferred to St. John's from Fitzwilliams House where the Indian High Commission had placed me. In the Cambridge system, it was obligatory to have dinners in the college hall, and we had at least five dinners there every week. It was quite natural that Salam and I and a few others started taking dinners together because of our common background and language, and this group became very close. We used to walk together, go to movies together, and when we did not feel like working we went to each other's rooms and talked Punjabi till late hours. After having done Part II of the Mathematical Tripos in two years, Salam joined Natural Sciences Part II. He was miserable in the laboratory and when he took the examination in 1949 he was very apprehensive. But after seeing his result, he came to our rooms to give the good news that he had again got a first. He also described the following amusing incident. He said that after looking at his result at the Senate Hall, he met one of his lab supervisors, who said "Salam, how did you do?" Salam said: "Sir, I have managed a first." The man turned a full circle on his feet and he said: "This shows how wrong one can be."

Salam had now completed three years of his stay at Cambridge. He had a double first and his scholarship had come to an end. He was planning to go back home, take the Pakistan Civil Service examination and start playing his role as supporter of his family. Then, Fred Hoyle, I think, told him that the college would like him to stay for research and was willing to give him an exhibition for the purpose. Salam came to our rooms, which Nitya Nand and I were sharing, and said "Look, now what should I do? College is offering me this scholarship. On the other hand my father is not getting younger, my brothers are growing up, they need my emotional support, they will need my financial support also. It's time I went and earned something for my family, and here they're asking me to stay on for research. I have my obligation to my community also. I would be useful to them if I join the higher Civil Service." (Nitya Nand and I used to discuss our plans and common concerns with him.) We told him: "Salam, Pakistan has many people who would make good administrators, maybe better than you, but it's hardly likely that there'd be anybody who would be able to make the type of contribution to science that you may be able to make." Salam spent a couple of agonising days and came back to our rooms in the college. He said: "Look, I am going to pack my books and some other things in two trunks and leave them with you. I will go back to Pakistan. If I can manage something which allows me to help my family and also pay my way here, I'll come back and retrieve these trunks. Otherwise, you ship them back to me through Thomas Cook."

He went back. With the help of Sir Zafrulla Khan, I think, he was appointed Professor of Mathematics at Lahore Government College, given leave on full salary to be paid to his father, and sent back to Cambridge for work for his PhD. So he came back and persuaded Kemmer to supervise him. Kemmer told him that he would give him no problems and suggest no solutions, and the only thing that he could expect was that he could talk to him whenever he wanted to. For some time Salam was miserable because he was not able to find any good problems. He used to come to our rooms and use very strong Punjabi expressions telling us that we were his enemies, not friends. We had misguided him, and instead of Salam the successful, now we were meeting Salam the unsuccessful. And that we had done him a great disservice. Very soon he discovered Thursday Seminar, Matthews, and renormalisation. After that there was no looking back.

I was going to Princeton in 1950 on the invitation of our old teacher, Professor S. Chowla, and Salam said: "If you meet Dyson, you tell him that I have renormalised longitudinal photons." I happened to meet Dyson and mentioned this to him. He said: "I don't believe it, but if he has done it he will be very famous." And he is famous. On my telling Dyson that Salam had taken up this work because of his suggestion in one of his papers, Dyson said: "I had said it should be done, not that it could be done."

Salam was elected to a Fellowship of St. John's College, Cambridge in 1951 and I got elected in 1952. I came to Cambridge in 1954 for residence for a few months. During this time I again had an opportunity to spend a good deal of time with him, often enjoying the hospitality of his wife. Even then Salam had started thinking seriously of taking steps for the development of science in our countries. We both felt that one of the great difficulties for young scientists in our countries was isolation from active workers elsewhere. As we all know, Salam's motivation for ICTP was to provide a place where young researchers from developing countries could interact with their peers and seniors and leaders of science from all over.

After 1954 we went our different ways. We met occasionally, for short periods, but whenever I met him he forgot his greatness, he forgot his achievements, and he reverted back to the old days talking about old friends and the times we had together. When my daughter, who is a mathematical physicist, met him at Trieste, he wrote in her autograph book some very flattering remarks about me. Out of her reverence for Salam, she is willing to consider that I am not entirely useless.

It was my great fortune to be associated with such a nice human being who was one of the greatest contributions to mankind from our part of the world, and I am grateful to you for letting me pay my tribute to him.

RAM PRAKASH BAMBAH, a distinguished mathematician from India, is Professor Emeritus of Punjab University, Chandigarh. His association with Abdus Salam goes all the way back to Government College, Lahore, where they were students together from 1942 to 1946. They were again together at St. John's College, Cambridge, from 1948 to 1950 as students and from 1952 to 1955 as Fellows. Professor Bambah is a Fellow of the Third World Academy of Sciences.

DELIGHT IN ABDUS SALAM'S COMPANY

John Ziman
Professor Emeritus of Physics
University of Bristol
United Kingdom

It is not so easy to follow Professor Bambah, because he has told us of the background of that brilliant and beautiful man whom we knew. Therefore, I shall carry on from the summer of 1954 where Professor Bambah effectively stopped off, because that was the actual moment at which I met Abdus Salam. And I shall tell you how it happened.

I was in Oxford at that time and just about to take a lectureship in Cambridge. John Spears, who was a theoretical physicist in Oxford, said to me: "Ah you're going to Cambridge. You will meet Abdus Salam and you will know who he is by his conversation." His conversation was like this: "Dispersion relations — oh, ho ho ha ha. Meson physics — Oh, ho ho ho, yes, ha ha." So I went on a visit to Cambridge just before moving there, and as I was walking down King's Parade I saw John Ward, whom some of you have heard of, who was with this man. He started his conversation and sure enough that was the way he talked. But his laughter wasn't just about everyday things — you know that anybody might after all be rather cheerful outside his work. With him laughter was part of physics.

I have been reflecting upon the fact that when Professor Bertocchi and Professor Fonda referred to their readings from Salam's books, they told me that what they read in those texts was as nothing to what they would have gotten from this laughter and from the delight that radiated around him in relation to the world of physics. They used the word "delight" and that is exactly the word I had written down myself while reminiscing on such a great person.

Before coming to the direct connections I had with him later, let me say something on an episode which occurred in this building in the seventies when I was quite frequently in Trieste. As I was going into his office to discuss something, he was on the telephone talking to someone who had done an experiment that might or might not test the Salam-Weinberg weak interaction theory. It later occurred to me that he did not need the internet. Nowadays, everybody uses internet in order to have those continual conversations which probably distract everyone from doing his real theoretical physics. I am not sure how one does research when people are sending you messages. I would assume that one should better sit down quietly and get on with physics: this is how we were taught to do it. But with Salam, it was on the telephone. He was already networking all through those days, building up his knowledge of physics, friendships, connections with people and carrying out this diffusion of the delight, the marvels, the beauties, the pressures of the great discipline in which we are engaged.

Now let me turn to another side. I have to say that we were contemporaries, we were lecturers together in Cambridge from 1954 to 1957. I used to see him around there and we knew each other well at that time, but we were working in different fields and so there wasn't a very direct contact. In 1957 he went off to Imperial College and I went in due course to Bristol. And then in 1966, I got a message from him; would I come and drop in on him at Imperial College, he wanted to talk to me about something.

I have to say that at that time I knew that he had set up this international centre at Trieste. What was it all about? Why did we need an International Centre for Theoretical Physics? Every good university was an international centre for theoretical physics. And so on. I had my own views on the subject and was a little bit doubtful about the whole thing.

However, I went to him at Imperial College and within a moment or two he did to me what he used to do to everybody. He would take you by the arm and he would say: "John, I want you to go and run the condensed matter physics courses at Trieste." The thing he might have asked was "I want you to go to Valparaiso tomorrow, on mission." You know, whatever it was, it seemed to be something you didn't have a doubt about doing. But the trouble was, I had suddenly discovered inside me that for that request from Abdus Salam there were only three answers. One of them was: "Well, it's against my religion to go to Valparaiso." You had to have a really strong view. He being a deeply religious and sincere man, that would have probably been enough, I think. The other answer might have been: "I'm very sorry but actually that very day I must be in Singapore, I can't avoid it, it would be unfair to do it." That was the second answer. The third answer was: "Yes, I'll do it. What do we do? How do we start? What's to be done?"

I discovered in him what I hadn't suspected from this friend of mine, from this cheerful, brilliant, lovely man that we knew around. I discovered that he was essentially a man of power. That his charisma, his power, was not simply in relation to the physics he could do and the way he would help people and so on; it was a power to persuade. I don't know where it came from. It was an irresistible passion in him that created passion. This was perhaps because one always felt that what was to be done was something worthwhile in itself and not something that he just wanted to do. It was a cause, a true cause. And of course we have seen how that passion created this great place here and many other institutions around.

All these things that were created by him owe, I suppose, their being to this power to persuade. I saw this in action doing courses here, serving on the Scientific Council of the Centre, and all these experiences over the years. I have seen it being applied to the officials of the IAEA who were, I think, fairly a pushover. On the other hand, the Italian Government was a slightly more complicated business and they had to be persuaded. In fact I am delighted to see Paolo Budinich here because Paolo had a completely different way of getting things done. The skilful, knowing, Italian way of doing it, which is quite different from the way of doing things of the Pakistani man of power. But somehow, between them they got things done.

There were moments actually when there were, at the Scientific Council, resolutions we had to pass, and we were told they had to pass and we never understood what they were, what they meant, but they meant another few hundred billion *lire* or so from the Italian government and therefore it was worth doing it. He applied this power to UNESCO and to all sorts of visiting people and got these things done.

I also feel, that this power was used more gently to the staff and I am glad to see Miriam Lewis here, but others who were the staff of the Centre, although they may have cursed him quite a lot of the time, knew that they were working for a great man and that he was behind them in their efforts. And this is what made this place a lovely place to be at because it was run very efficiently, everything worked and yet there it was totally unbureaucratic.

I have been asked to read the message from Stig Lundqvist, but before I do that, I have a question for those who knew Abdus Salam well. And my question is this: What exactly is *ossobuco*?* Whenever we went out to our local restaurant in Trieste, he always had *ossobuco*. I tried it. A very good, nice dish, but I was so fascinated by his particular love of that dish. I never

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actually discovered what precisely was in it. Perhaps that's more important than knowing how many quarks there are in a nucleus!

Now, I shall take over the final item of this morning's session which is the message from Professor Stig Lundqvist. I was asked to do this because Stig Lundqvist and I worked together for many, many years in the programme of the Centre on condensed matter/solid state physics. I am deeply sad that his health prevents him from coming here. It doesn't say so in this letter but I know that it is so because he was deeply devoted to the Centre and to Salam. Altogether he is one of the most admirable and lovely people that gathered around in this Centre and my close and warm colleague for many years.

* bone marrow.

JOHN ZIMAN, FRS, is Professor Emeritus of Physics of the University of Bristol, UK. He was a Lecturer at the Cavendish Laboratory in Cambridge from 1954 to 1964, and then became Professor of Theoretical Physics at the University of Bristol where he stayed until he took early voluntary retirement in 1982. In 1966, Abdus Salam invited him to launch programmes in condensed matter physics at the ICTP and, for the next thirteen years, he chaired the committee that organised a series of Winter Colleges at Trieste. He has also been a member of the ICTP Scientific Council.

THIRTY YEARS OF CONDENSED MATTER PHYSICS

Stig Lundqvist
Professor Emeritus
Chalmers University of Technology
Gothenburg, Sweden

I got to know Abdus Salam already during my years in Uppsala in the fifties. As he was a scientific secretary of the big international conference to be held in Geneva on the peaceful uses of atomic energy, he became a very good friend of my teacher Ivar Waller, and Waller later became a summer guest at the Centre all the years up till his death at the age of 92.

The Centre started with a small budget in 1964. The first years were mainly devoted to particle physics. After a few years, Abdus Salam's advisers recommended him to diversify and expand the programme by including activities in condensed matter theory. The condensed matter activity set off in 1967 with a real bang. It started with a three-month course with a large number of key physicists lecturing. The Directors were J. Ziman, G. Cagliotti and F. Bassani. When Ziman left after a few weeks he entrusted the day-to-day running of the course to me, and since then I have been closely associated with the condensed matter programme.

In 1970 the programme was enlarged to include an annual three-month workshop in the summer and I was appointed the Director of that activity. I have had several wonderful collaborators in this project, such as Norman March, Paul Butcher, Elias Burstein and many others. This was in addition to an extended course on condensed matter physics which was held every second year. Later in the seventies, Erio Tosatti became a professor at the International School for Advanced Studies (SISSA) of Trieste and a consultant for our programme. We always had some small conference in the summer and he was very helpful in organising these meetings and suggesting suitable topics.

All these years I had very close contact with Abdus Salam. We discussed the scientific programme and above all the interesting new physics he was doing. The possibility of a Nobel Prize for him was coming close and as I was a member of the Nobel Committee, these discussions became very complex.

In the early eighties an important step was taken when Yu Lu was appointed to a leading permanent position at the Centre. He has done significant work as a leader and his initiatives have been instrumental for the development of the condensed matter group.

Around 1984 the ICTP got an unexpected major financial contribution. Instead of spreading the goodies thin over all the programmes, I suggested to start a new series of conferences, which we called the Adriatico Research Conferences. They would be partly pedagogical and we decided to have long morning lectures, a total of 12 per conference, giving the major outline and presentation of the theme. The rest of it would cover mainly technical topics. The conferences were not restricted to condensed matter physics, but had a much wider scope. We have had up till now 64 Adriatico Research Conferences. Some of them have been centred on very tiny topics. As a whole they have covered a very wide area. Abdus Salam gave us great support for this scheme.

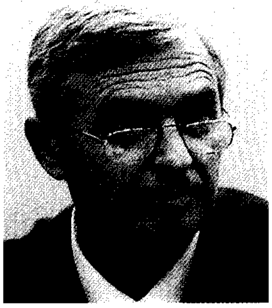
This year we have been running the condensed matter programme for 30 years. All this time Abdus Salam has been strongly supporting my activities and he has also been a close friend. He has given generous moral and financial support for our programme. For me it has been a great experience to work with him and I wish to thank him for all his support and encouragement. I consider Abdus Salam as a very close friend and I sincerely miss him.

STIG LUNDQVIST is Professor Emeritus of the Chalmers University of Technology. He was born in Gudmudrå Sweden, in 1925. He obtained his PhD at the University of Uppsala, where he then became assistant professor. In 1961 he joined Chalmers University of Technology in Gothenburg, and in 1962 he was appointed full professor. His collaboration with the Centre started in 1967 on the occasion of the first extended course on condensed matter physics. Later, in the early seventies, he launched the summer workshops on condensed matter and, in 1986, the Adriatico Research Conferences. He became a member of the ICTP Scientific Council in 1982, and served as its Chairman from 1984 to 1992. Professor Lundqvist is a member of several academies and learned societies.

SESSION III

Chairman: Miguel Angel Virasoro

Rexhep Meidani
Gioacchino Fonti
Aniello Izzo
Eugenio Campo
Roberto Damiani
Hans Blix
Adnan Badran
Mohamed H.A. Hassan
Lydia Makhubu



A LIGHTHOUSE FOR YOUNG SCIENTISTS

Rexhep Meidani
President of Albania

All of us know who Professor Abdus Salam was: the founder of ICTP.

The numerous international prizes, awards, doctorates and citations given to him were like steps that helped him climb the ladders to celebrity and stardom.

The foundation of the International Centre for Theoretical Physics, based on the ideas put forward by Salam, was a pioneering initiative to keep alive the higher education, the research and creative power of thousands of scientists, and many more in the future. It was a lighthouse for young scientists sending rays of light illuminating the dark paths of difficulties in the developing countries. The United Nations organisation was established to promote peace in the world and the International Centre for Theoretical Physics was founded as an instrument of this peace with a new visage, the visage of science. This investment and its benefits have always been visible and coherent.

And now after one third of a century from its birthday, we shall add to the initials ICTP — the symbol of wonder, spirit and co-operation of science — the name of one of the greatest personalities of the physics community, who devoted his life to keeping the morale of the poor scientists from developing countries alive and fought to prevent their pulling power from sinking to absolute zero. These new letters embody the name of the father of physics, who dedicated his energy to kindle the enthusiasm of young physicists, gathering them with celebrated peers from industrialised countries, respecting the principles of French illuminism: *liberté, égalité, fraternité*, organising face-to-face communications between young and experienced generations, between fresh ideas and old ones, crazy concepts and standard ones.

I would like to emphasise that in my scientific career two moments stand out. The first relates to my post-graduate studies and research work at the Centre d'études nucléaires at Saclay in France, which allowed me to collaborate with a team of superb French scientists, under the institution's spiritual leader, Nobel Laureate P.G. de Gennes. During this time I not only acquired valuable knowledge but I also developed warm and lasting friendships. The second is linked with my studies at ICTP, Trieste where I was fortunate to meet Professor Salam, a great and generous man. During the course of a decade it was always a real pleasure to work and stay at ICTP. It is no exaggeration if I define this Centre as a goodness of Salam. Invented by this special scientific, political and diplomatic brain it has served as a modern concentrated model of spiritual freedom, intellectual independence and real humanity, of scientific salvation and encouragement for poor countries, and a symbol of sociability for all physicists around the world.

Salam's target was not only to create a scientific centre, but also to capture, through his human and spiritual imagination, the most advanced model of a community and a new building of collaboration, independent from race, religion, nationality or political affiliation, and moreover to light the path of an integrated peaceful world of free people with an open heart and original mind.

And I would like to believe, as Professor Salam did, that a new world will be possible through skilful advanced planning and real co-operation of scientists. Following Salam's ideas we must have the courage to think the unthinkable.

But, as elsewhere, to make the venture succeed, scientists will have to release, time after time, top-class or top-lab work and put in an enthusiastic showing also at political venues. There are good reasons for thinking that the intellectual and scientific brakes should be applied to proceed more cautiously when one deals with human demands associated with effective, integrated world governance.

In participating in the ceremony of unveiling the Centre's new name, The Abdus Salam International Centre for Theoretical Physics, I wish to salute the man who honoured not only his country, not only the physics community but all the scientists in the world, by his example and by his ideal of a more fraternal society, based on the principles of justice and the dignity of human beings, that he embodied himself.

I am pretty sure that both his example and his ideal will continue to inspire not only his collaborators at the Centre, but all of us who share his belief that such a world is possible.

Better than anyone, Professor Salam understood what pragmatic policy and concrete diplomacy meant, and he applied them successfully. He was a real ambassador of physics in the political and economic communities, contributing everywhere to the financial survival of the Centre. He often said that scientific thinking helps society address its problems in a rational and systematic way. And I share the same belief that science helps people change their outlook on the social and economic problems they are facing. In essence, it is normal to think that scientific reasoning helps to find the important detail, the simplest one perhaps, in the complexity of questions, evidence and facts, to make predictions based on analyses and synthesis, on different levels of abstractions. Of course, the complexity of problems in social life or in the economic sphere cannot be explained by the so-called many-body theory and it is different from the scientific one, but the way of facing them and the methodology are the same. Also, there is no doubt that the scientific concepts are extremely useful in modern social and political life. Some days ago, at a meeting with local authorities in one district of Albania, I explained why a factory there was inefficient, based on the concept of critical mass for production. Analysing this case and developing this idea more concretely, I pointed out by different examples that the concept of critical mass (related closely to the transition from quantitative to qualitative changes) is not only a scientific or philosophic concept, but also a political, parliamentarian, economic, financial and social one, in a pluralistic system and a market economy.

Was not the concept of critical mass or critical size that was developed carefully by Salam quite important for the success of the physics community in any given country? It was this concept that generated the necessity of the foundation of the Centre.

It is true that politicians rarely choose physics as their major area of study, but Salam thought that science, and particularly physics, offer a kind of training that fits well with the intellectual and spiritual demands associated with effective governance. Considering this fact, I am sure that many scientists, responding to the conditions that their nations will face in the near future, will become actively involved in efforts to rebuild a new democratic world, their nation's democratic institutions as well as international equitable co-operation following the spirit and the main human characteristics of scientific activities, which are concentrated in Rutherford's expression: "Science is international."

I would like to emphasise another important problem for scientific and technological development and for furthering human civilisation, to which Salam made a great contribution; that is the support of basic scientific research.

Of course, efforts to obtain immediate concrete results through basic scientific research can often be a heart-breaking exercise with a lot of problems and difficulties. This is also nurtured by the pessimistic view that many of the world's problems — including problems in science — were brought about because people, particularly politicians and economists, considered or saw the immediate benefits or gains rather than the long-term problems. It may be that this is partially true, but the history of science doesn't show that because, in general, a theoretical result of yesterday or today will be a fruitful application for tomorrow.

There are barriers, but through persistence and the tunnel effect the optimists of basic research will win one day, despite a few little headaches. Yet, given the level of intellectual capacity now found among the researchers both in industrialised and developing countries, I am certain, as Professor Salam was, that basic scientific research will play an important role, particularly in the long term. This role will find its expression not only in the acquisition of new knowledge but in the transfer of technology that will have a positive impact on the nations' social and economic well-being. To meet these challenges, the universities, or more specifically the departments of science in developing countries, will seek to increase co-operation with institutions in industrialised countries. Like here at the Centre, based on Salam's initiatives, a new policy has to be applied, pursuing joint conferences, seminars and courses to keep the researchers and students everywhere up-to-date on global scientific findings. To this end, new centres of co-operation or different organisations have to emerge and the concept of devolution has to be applied to generate new ways. Also, regional co-operation, in different fields, across old national borders (which sooner or later will evaporate as in Europe, as the European Union integration progresses) may in time engender a new set of collective organisms and mechanisms that weaken the pull of the old nation states. In this way, there is a chance to make some steps ahead towards the globalism of science, to enjoy other episodes of relatively rapid evolution, following closely that of the global economy. In this still imperfect world, where contacts count for so much, it is better and more fruitful to join in, rather than stand outside and wait for change.

Today, more than ever before, dedicating our sentiments to Professor Abdus Salam, I believe that each of us, as individuals, must not only struggle to make a better world, to build a new conscience, but also to make ourselves better and conscientious, for the important role to be played in our world. In this perspective, I think that we could at least feel and say that Professor Salam was for us, for our physics community, for science and all open-minded societies in general, a chance of grasping and catching these problems at an early stage and of lighting our own path.

In unveiling the Centre's new name, The Abdus Salam International Centre for Theoretical Physics, my greetings are: "Many happy returns of this new birthday."

REXHEP MEIDANI, who was elected President of Albania in July 1997, is an accomplished theoretical physicist. At the time of his election, he was Professor of Physics at the University of Tirana. Over the past ten years, President Meidani has come to the ICTP on ten different occasions to attend research workshops in condensed matter, high energy and computational physics. All told, he has spent more than a year in Trieste.

WE SHALL MAINTAIN THE LEVEL OF EXCELLENCE OF THE CENTRE

Gioacchino Fonti
Representative of the Italian Ministry of the University and Scientific Research and Technology

It is an absolute privilege and a true honour to pay, on behalf of the Italian Government and especially the Ministry of Research, our heartfelt and sincere respects to the memory of Abdus Salam. Being here today and participating in the ceremony not only respects the tribute rightfully deserved by a great international personality and, among other things, recipient of the Nobel Prize for Physics, but also means supporting and sharing an idea: that science is an irreplaceable instrument of peace, welfare and social growth throughout the world.

Conceived through the torment of his own personal experience which brought Abdus Salam to carry out his mission of research scholar outside his home country, the birth of the International Centre for Theoretical Physics constitutes a clear and concrete response to all those sceptics who deny science the power to overcome social, political and ideological barriers and to provide humanity with the key to progress and development. The Centre has hosted scientists coming from over 150 Member States of the United Nations, the IAEA and UNESCO, for a total of 60,000 visits.

The annual number of visitors, which in 1964 was merely 83, has reached about 4,000 in the nineties. Around 53% of these visitors came from developing countries. The activities of the Centre are quite varied: from workshops to scientific conferences, from laboratory research to award presentations. Of particular importance is the Associate Scheme which allows high-level scientists who live and work in developing countries to remain in regular contact with the more modern aspects of their field of research. This is a programme which helps to reduce brain drain in the Third World.

This brief overview of the Centre is sufficient to testify to the success of the institute which, moreover, has found its ideal location in Trieste.

Trieste, meeting-point of western and eastern European, as well as of Mediterranean, cultures. An appropriate location, therefore, for the rise of models of international co-operation in the field of science, whence the name "the city of science".

But this is not all. The example of Trieste did not fail to encourage also the creation of other centres elsewhere in the world, such as the Centro International de Fisica, Santa Fe de Bogotà in Colombia, or the Pacific Center for Theoretical Physics in Korea, to name but a few. If all this, on one hand, brings us sadness since the person who started it all is no longer with us, on the other hand it comforts us when we look again at the ICTP. The Centre is alive and well in the scientific legacy, the commitment and the achievements left by Abdus Salam. We are certainly aware of the well-deserved reputation of the Centre throughout the world's scientific communities, and we pride ourselves in knowing that it has contributed to projecting an image of our country which differs from that stereotyped by the mass media. Also worthy of consideration is the prominent role it has played as pioneer in the establishment of the so called "Trieste system" within which such scientific enterprises as the International Centre for Genetic Engineering and Biotechnology (ICGEB), the International Centre for Science and High Technology (ICS), the International School for Advanced Studies (SISSA), the Research Area, and the Synchrotron Laboratory have been developed.

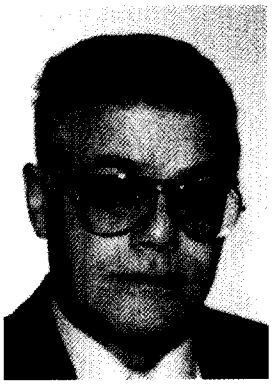
Consequently, I cannot but re-emphasise that it is a special honour for me to represent, on this occasion, the Ministry of Research, the governmental administration which, as a token of its institutional objectives in the co-ordination of research activity (including its international components) as indicated in the Ministry's statute, has assumed a role of tutelage for the Centre. This means that the Ministry's contribution to the Centre has but one objective: to guarantee the validity and the quality of scientific life and of the activities which take place here at the Centre, as well as elsewhere in the world in the name of the Centre.

As Government representatives, we are proud of having been able to support Abdus Salam at the right moment in the fulfilment of his dreams. And we, together with his successors, undertake to maintain the same level of excellence at the Centre, now named after him and therefore, a monument to his memory.

I shall conclude by conveying the greetings of the Minister of Scientific Research and Technology, Professor Berlinguer, with his best wishes for the continuing expansion and increasing success of the activities of the Centre.

(Translated from the original version delivered in Italian.)

GIOACCHINO FONTI graduated in Law from the University "La Sapienza" in Rome. After two years (1973-1975) at the Court of Accounts as an auditor, he joined the Ministry of Public Education as a Counsellor and was promoted to Senior Manager in 1986. Since 1992, he has worked at the Ministry of the University and Scientific Research and Technology, where he directed the First Office of the Department of International Relations. Since 1996 he has been the Director of the Sixth Office of the Department for the Development and Strengthening of Research Activity, which is involved in all aspects of national and international scientific and technological co-operation. In this capacity he represents his Ministry in numerous international committees and multilateral bodies.



WE DEVOTE SPECIAL ATTENTION TO THE CENTRE

Aniello Izzo
Representative of the Italian Treasury

I am honoured to have been invited to participate in this special commemorative ceremony which announces the unification of Professor Salam's name with that of the International Centre for Theoretical Physics.

I have had the pleasure of knowing and appreciating the special qualities of Professor Salam personally, both in his scientific research and in his exquisite sensitivity within working relationships. I am certain that although he is unfortunately no longer physically present, Professor Abdus Salam would take great delight, perhaps he is already delighted, in learning that the Italian Government's contribution to the International Centre for Theoretical Physics has finally acquired a status of continuity, precluding any future risk of financial crises.

Before concluding my short speech in honour of Professor Salam, I would like to thank first of all the local authorities for their exceptional contribution in favour of the Centre, and likewise the specialised agencies of the United Nations, in particular UNESCO and the IAEA, for their support of the Centre's activity for which I can guarantee the financial contribution of the Italian Treasury. This contribution, which, as you know, has been increased considerably in recent years notwithstanding the unfavourable national budget situation, is granted in order to allow for the continuation of the activities and the development of programmes geared at improving educational initiatives in favour of developing countries.

In this context, I would like to point out that our Ministry devotes special attention to the activities of the Centre which are directed, after all, at disseminating scientific knowledge in its various aspects, and which will certainly contribute to the training of the future leaders who will have to uphold the growth of co-operation between industrialised nations and the developing world, for a favourable evolution of the global economy.

(Translated from the original version delivered in Italian.)

ANIELLO FRANCESCO IZZO graduated in Economics and Commerce from the University of Naples, Italy, in 1962. He has been Secretary (1970) and Counsellor (1972) to the Minister of the Treasury, and Section Director at the Department of Economical Affairs of the Ministry of the Treasury (1979-1998). Since 1979, Dr. Izzo has represented his Ministry in many United Nations and European international organisations and served on financial committees of the same. He is a component of the ICTP Steering Committee and takes part in the Italian National Commission of UNESCO. He was also a member of the Committee for Co-operation in Developing Countries of the Ministry of Foreign Affairs from 1993 to 1996.

THE ITALIAN GOVERNMENT'S COMMITMENT TO THE VISION OF ABDUS SALAM

Eugenio Campo
Representative of the Italian Ministry of Foreign Affairs
for
Lamberto Dini
Italian Minister of Foreign Affairs

As a representative of the Foreign Ministry, I feel honoured to read to you the message of the Italian Minister of Foreign Affairs, Dr. Lamberto Dini.

I deeply regret not to be present here at this meeting of distinguished personalities to commemorate Professor Abdus Salam, Nobel Laureate, at the seat of the International Centre for Theoretical Physics, which, as of today, bears the name of the outstanding scientist and man of vision. With this regret, I wish to convey the most cordial regards of the Italian government, the foreign ministry and mine, to Professor Meidani, President of Albania, to the authorities, to the members of Professor Salam's family and to all the scientists here convened to honour their master and colleague.

The government of Italy is united with you in honouring Professor Abdus Salam and his contribution to science and mankind. I do not say this as a sign of formal participation in this commemoration, but considering the informal relations, and in many cases, the profound friendship, that many members of the government, prime ministers, ministers of foreign affairs, and ministers of science and technology have entertained with him for a long time. Indeed my country, the government, the region and the city of Trieste are indebted to the broad vision of Professor Abdus Salam, which has led to the creation in Trieste of a pool of real scientific excellence in the system of the United Nations, committed to the progress of science and technology in developing countries.

In a letter to one of my predecessors, former Minister of Foreign Affairs Andreatta, Professor Salam wrote that the Centre was created to serve the needs of the developing countries and must continue to do so. The fact that scientists from these countries come to work in a place which is their scientific home, where they are not considered as guests as in other scientific institutions in the industrialised world, is what distinguishes and characterises the Centre. And this certainly confers prestige to Italy as the host country of ICTP.

Under the direction of Professor Salam, the ICTP has become one of the leading scientific centres of the world: a centre of excellence in the real sense of the term, as important for the developing countries as for the industrialised world. The Italian government is proud to have been associated with this enterprise.

Following his impulse and enthusiasm, a constellation of new centres has been created around the ICTP. All of them are directed towards the same goal indicated by Professor Salam; that is of responding to the needs and aspirations of developing countries. I mention here the International Centre for Genetic Engineering and Biotechnology, the International Centre for Science and Technology, — which, as Professor Budinich said, is still a project to be turned into a new leading centre in this field — the International School for Advanced Studies and finally the Third World Academy of Sciences. Also the latter is an organisation which we intend to strengthen and to provide with the support that it needs. This is really the intention of the government of Italy, to push the process of co-ordination and synergy among all these centres in the direction of the establishment in Trieste of the Faculty of Science of the United Nations.

On behalf of the Italian government, and the Ministry of Foreign Affairs in particular, I wish to thank all the scientists who have co-operated with Professor Salam and worked so hard, often under difficult financial stress, to create this Centre of which Italy and Trieste are particularly proud. I wish to assure Professor Virasoro and the directors of the other centres inspired by Professor Salam that while they are continuing his work, the support of the Italian government for their efforts will be pursued with determination. As I said before, the Italian government is fully committed to the vision of Professor Salam, that the Centre should serve the needs of the developing countries. In this direction, the government and the Ministry of Foreign Affairs will consider the Centre an invaluable and important tool of their general co-operation policy. I think that this commitment is the best way to honour the memory of Professor Salam.

EUGENIO CAMPO is a diplomat presently working at the Directorate of Cultural Relations of the Ministry for Foreign Affairs, where he is very active in promoting scientific international co-operation. He has been in the diplomatic service since 1970, and has been on duty for extended periods in Italian embassies in Nigeria, China, Yemen and the United States of America.

A NEW ROLE FOR TRIESTE

Roberto Damiani
Vice-Mayor of Trieste

I am very delighted to extend to you the warmest greetings on behalf of the city of Trieste.

As compared to other cities in Europe and elsewhere, the traditions and the cultural and civic history of Trieste are relatively recent. Its geographical location, however, has a natural importance. Trieste is indeed the northernmost port in the Mediterranean and the nearest port to the Central European capitals. It is also the meeting point of the three major ethnic and linguistic groups in the old continent: the Latin, the Slavic and the German.

After having been for a long time a social and economic centre of secondary importance, Trieste finally found its true vocation in 1719, when its strategic position was recognised and it was made a free port of the Austro-Hungarian Empire. It then rapidly became an international entrepôt. In order to exploit this potential it also had to take full advantage of the skills of the entrepreneurs and craftsmen of all races, languages and religions who were attracted to the city by these opportunities. This distinguished past of exemplary tolerance in those days when Trieste became the second largest port in the Mediterranean, by volume of trade, has bequeathed much to the modern city.

Trieste has churches, temples and cemeteries of all the major religions as well as a richly woven population in which the typical Triestino is the result of a blend of backgrounds linked to the free choice of the Italian language in a setting of international culture. Trieste possesses all the credentials to play a role on the international stage, a part which remained stillborn when the city passed under the Italian administration after the first world war. It again remained in the wings after the second, when the cold war forced upon it a new role as a centre, and Trieste became an outpost of the free Europe on the iron curtain border. With that role Trieste was able to don its old costume again with the difference that its experience of free trade in goods enabled the city to spot the growing importance in today's world — which will become vital in tomorrow's — of the free exchange of ideas and scientific thought.

The origins of the ICTP lie in Trieste's newfound confidence in its role as a link, not only between east and west, but also between north and south. This has been bolstered by the excellent results achieved by the ICTP in the field of scientific co-operation which, in turn, have led to the birth of new scientific institutions of international reputation. However, if Trieste is now in a position to play an important and delicate part in international relations, this is largely thanks to the efforts of those who had committed their time, energy and intelligence to bringing about the vision of the city's future. Foremost among these, but representative of others, is our friend Paolo Budinich.

Even so, their efforts alone would not have borne fruit if they had not come across others who believed in this town and were prepared to devote their energies to its welfare, though they had no personal background linking them to it. Abdus Salam was one of these.

Indeed, he was the most effective champion in the way he embraced Trieste's cause with both enthusiasm and rationality. He saw that the city's ambitious aim offered the prospect of combining the struggle for progress and freedom in science with that of the progress and freedom of all men, regardless of language, culture, religion and colour of their skin. Trieste was proud to confer honorary citizenship on Abdus Salam. Few had received it. But I believe that this gesture fairly reflected the city's deep sense of gratitude for Abdus Salam's extraordinary work. This is another reason, Mr. Chairman, why the Trieste municipality is proud to associate Abdus Salam's name forever with this study and research centre, for which he battled with such energy and dedication.

ROBERTO DAMIANI was born in Trieste in 1943. He serves as Vice-Mayor and Counsellor for Culture of the city of Trieste. He is Professor of Contemporary Literature at the University of Trieste, where he was also in charge of international relations from 1981 to 1987. Author of numerous books, he has also pursued an intense career as radio script-writer, television commentator and playwright. He is the President of the International School of Trieste, President of the Teatro Stabile di Prosa (permanent playhouse) of the Friuli-Venezia Giulia region, and Vice-President of the Foundation of the Cassa di Risparmio savings bank of Trieste.

A GREAT INTERNATIONAL SERVANT

Hans Blix
Director General
International Atomic Energy Agency

I am happy to be with you here today to commemorate Abdus Salam. It is fitting that, as of now, this Centre be renamed The Abdus Salam International Centre for Theoretical Physics. The ICTP is the brain child of Abdus Salam. Its reputation world-wide is solid, and its firm institutional bases are due above all to the farsightedness and the tenacity of its founder and first director. What we take for granted today has been earned thanks to the efforts of Abdus Salam and his deputies Paolo Budinich and Luciano Bertocchi, to the generosity of the Italian government and the city of Trieste, and to the support of the two parent organisations, the IAEA and UNESCO, as well as of the many other bodies and of the individuals who have been active here.

Abdus Salam appeared for the first time on the scene of the International Atomic Energy Agency as a Delegate from Pakistan at the IAEA's General Conference in 1960. Let me quote from the minutes, which I looked up a few days ago, of the 39th plenary meeting at the Neue Hofburg on the 22nd of September 1960. Abdus said then, I quote from the minutes: "His delegation and others proposed that the Agency should sponsor an international institute of theoretical physics. Such an institute would need no laboratories or costly apparatus. A modest building containing lecture halls and a library would be sufficient. The staff would work on nuclear theory, the theory of elementary particles, reactor theory and the theory of thermonuclear fusion. At first the institute would award about 50 fellowships a year, half to experienced physicists who would be granted one year's leave for the purpose by their respective institutes. A similar system, he said, had proved successful at the world famous institutes in Copenhagen and Princeton."

The proposal was moderate indeed and in line with the mandate of the IAEA, but it took some time to materialise. It was assessed by several committees and discussed at meetings of the Board of Governors of the IAEA, and of the General Conference as well. Eventually, it was decided to establish the International Centre for Theoretical Physics in Trieste, the seat selected among several other options, and it was officially inaugurated in 1964.

What Abdus Salam has left us is about ten times the size of his initial project. The "modest building", as he termed it, that he wanted is now a complex of four edifices and the 50 fellows have become some 4,000 scientific visitors every year, and as I heard from the Italian representatives, about 60,000 totally over the years.

Abdus used all his persuasiveness, which was not limited, his charm, and contacts which were also unlimited, to achieve these results. The Nobel Prize for Physics which he received in 1979 gave him a status that also helped him to achieve the expansion and which he used very much in order to get the expansion. Because of its instant success and a pressing demand, the Centre launched programmes into new disciplines; mathematics in 1970, atomic molecular and laser physics in 1973, geophysics in 1975, and many others became regular features of the activities here.

The IAEA was responsible for the operation of the Centre from the outset. But from 1970 and onwards, UNESCO, which provided fellowships from the very beginning of the Centre, joined the IAEA in this responsibility. As the scientific programmes of the ICTP came to cover much more than the fields which fell within the mandate of the IAEA, and as UNESCO has a broader mandate than we do, the administrative and financial responsibility was turned over to UNESCO in 1996.

However, I can assure you that the IAEA has continued to support the Centre, very much so, with money, particularly those programmes which are relevant to its mandate. There are still courses run in co-operation with us — I saw one on the list for the coming year. Indeed at the IAEA we believe that the Centre has helped to strengthen also the image of the Agency as an organisation, which although often operating in fields which are highly politically charged, is engaged in and remains faithful to, and respectful of science.

During my 16 years as Director General of the International Atomic Energy Agency, which will end next Friday, I have had many opportunities to meet Abdus Salam in Trieste and in Vienna and for admiring his brilliant intelligence, his innovative way of attacking problems, and his unyielding energy and impatience with red tape. Abdus had a passion for the progress of the less privileged countries in the world. His constant message was that these countries must develop their own science and capacity in science. He himself helped greatly to achieve that. Let me also note that Abdus' thoughts did not focus only on equations and scientific formula. He was also warmly a religious man with a strong sense of moral duty.

I want to use this occasion also to express the appreciation of the IAEA for the constant and generous support of the Italian government to the financial and other needs of the ICTP. And my thanks go as well to the authorities in Trieste for all their help and their generosity in providing the splendid buildings which constitute the "Campus of Miramare". Trieste and Italy were unique in offering, during the cold war, a serene oasis for East-West and North-South co-operation in science. Happily the cold war is over, but the oasis providing the clear stream of science is as needed as ever.

Abdus Salam is a great man of contemporary physics. He belongs to the history of Trieste and to the annals of the United Nations. With his passing away, a chapter of the Centre's history was closed and another opened with new challenges.

Let me therefore, ladies and gentlemen, conclude by expressing my most heartfelt best wishes to Abdus' family, to his successor Professor Miguel Virasoro, to all the physicists and mathematicians who come to Trieste and contribute in their own way to the social and economic progress of their home societies and also, to all the dedicated staff of this Centre.

HANS BLIX was born in Uppsala, Sweden. He was the Director General of the IAEA from 1981 to 1997. Dr Blix has been involved in international issues since 1963 as Head of Department at the Swedish Ministry of Foreign Affairs, Under-Secretary of State at the same Ministry in 1976 and Minister for Foreign Affairs in 1978.

BRIDGING THE GAP BETWEEN NORTH AND SOUTH

Adnan Badran
Deputy Director-General
United Nations Educational, Scientific and Cultural Organization

Professor Abdus Salam, the Nobel Laureate, was a humble natural scientist from a developing country who was passionately in love with the ideals and the vision of the United Nations for creating a better world based on justice, human rights and democracy by bringing together those who "have the knowledge" and those who "have not".

I came to know Professor Abdus Salam very closely in 1980 when I invited him to address the first graduation class of my University, in Jordan, and to receive an honorary doctorate. I remember Professor Salam's words in his address to the graduates: "The globe of ours is divided into two distinct human beings: one quarter of mankind who exploits 80% of the world's natural resources, while three quarters are still developing humans called 'Les Misérables' living on three fifths of the globe." What distinguishes one type from the other is not a genetic character — both stem from mother nature DNA — but they differ in their level of mastery of knowledge — science and technology — and its utilisation for economic and social development.

Professor Salam has always been aware of the danger caused by the disparity between North and South and he knew that peace cannot flourish in our global village without analysing the global crises and the inequalities between the rich and the poor. Alleviation of poverty by deeds and not by words was continually in his mind to bridge the gap in humanity. The most important item on his agenda was capacity building in science and technology in the Third World that would allow to fill the breach in knowledge, to optimise international co-operation, to eradicate illiteracy in science, to mobilise resources for fighting the marginalisation of the scientists from the South and to bring the science of the Third World in the main stream.

To this end, he created the International Centre for Theoretical Physics (ICTP) as a model to bridge the gap in theoretical physics, applied mathematics and other fields of science between the North and the South; the Third World Network of Scientific Organisations (TWNSO), a network among centres of excellence in the South for overcoming seclusion and exclusion; and the Third World Academy of Sciences (TWAS), of which I am honoured to be Secretary General.

Knowledge is what the inquisitive mind discovers at the laboratory bench or in the field. To disseminate knowledge is to empower the minds of men so that they can apply it to peaceful use. This is the real formula for human development and eventually the main component of the agenda of peace and development for the future of humanity. To alleviate poverty, it is essential to develop the endogenous capacity of the South so as to overcome disparity and conflicts between "infos" and "infos not". With knowledge, poverty will be mitigated, and peace will be achieved. Empowering people with frontier areas of knowledge through sharing and caring will create a harmonious world, where interdependence through international and multilateral co-operation become a mode of action for the development of world society based on justice, human rights and democracy.

"I had two passions in my life:" said Abdus Salam, "one for the basic forces of matter at Imperial College, London, and the other for building a 'science transfer' to developing countries. I have been able to create at Trieste — under the auspices of the United Nations, the International Atomic Energy Agency (IAEA) and the United Nations Educational, Scientific and Cultural Organization (UNESCO), and with the generous help of the Italian Government — a Centre (the ICTP) for thousands of young physicists and mathematicians who come every year from the Third World to interact and get trained in the North. It is crucial that developing countries invest in science for a brighter future to their societies."

Professor Abdus Salam described his schooling days in a typical Third World context as follows: "When I was at school in 1936 in Jhang of Lahore in Pakistan, I remember the teacher giving us a lecture on basic forces in nature. He began with gravity. Of course, we all had heard of it in our town Jhang. Then he went on to say that there is a force called electricity but it does not live in our town; it lives in the capital city Lahore a hundred miles to the East. Then the teacher said: we just heard of a nuclear force but that only exists in Europe."

Once upon a time Professor Salam was a victim of this disparity. He then wrote: "When I returned home, I was the only theoretical physicist in the country, I had no one in my vicinity to talk to, to discuss or to share ideas with. The academic climate was not stimulating at all. After three years, I realised that staying any longer would not make sense. My work would deteriorate, the harvest of achievements in physics would go to waste and I would be of no use to my country. I reluctantly decided to return to Cambridge." Professor Salam had come to realise the inevitable: scarcity of resources and isolation were the fundamental causes of the growing migration of scientists from the developing countries to the industrialised world.

He made the comparison of the scientific manpower and he noted in 1990 : "There were 3,600 scientists/engineers per million population in the industrialised world. In Israel and Japan the figure was 5,500. But when we look at the Third World, there were only 200 scientists/engineers per million population. So, the critical mass is lacking. Adult illiteracy is a major obstacle of scientific and technological development. There are 850 million illiterates in the world, most, if not all of them, in developing countries."

Nobel Laureates are produced in the laboratories of the West. Those from the Third World who succeeded have made it while working in the laboratories of the industrialised countries. Basic research and higher education have been established to generate knowledge and to train technologists to integrate knowledge from various disciplines in the development and use of complex technological systems and to identify practical problems, the solution to which requires more fundamental scientific understanding.

Out of the 61 million students in the world, 2% are in foreign countries. Of these, 70% come from developing countries. Sub-Sahara Africa provides the largest contingent (14%). 80% of PhD students from the Arab region study abroad in science and technology. The United States receive over one-third of all students studying abroad (1990) which amounts to nearly 3% of all students in the country. There is an even greater proportion of post-graduate students in the USA from abroad: 28% of all graduate science students and 47% of engineering students. Yet, few Americans study abroad — less that 25,000 (1990). In front of these figures, Professor Salam always maintained: "Brain drain can be converted to brain gain if the scientists of the Diaspora plant their roots in more fertile soils abroad while some of the branches shed their fruit in the mother land."

The passing away of Professor Salam will be profoundly felt by the whole scientific community, particularly those of the South. He strongly believed that science education lies at the heart of all development and unless the Third World builds its own capacity in science and technology, it will not be free. Therefore, science and mathematics education should be given priority for the individual training throughout schooling up to training in fundamental research.

To conclude, I wish to evoke Professor Salam's exemplary vision which is reflected in his own words: "Scientific thought is the common heritage of mankind."

ADNAN BADRAN is a Professor of Biology with a distinguished academic career at the University of Jordan and at the University of Yarmouk. He joined UNESCO as Assistant Director-General for Science in 1990 and served as Deputy Director-General of UNESCO during the period 1996-1998. From 1988 to 1990, he was Minister of Agriculture and Minister of Education of his country. He is a Fellow and Secretary General of the Third World Academy of Sciences.

UNITING THIRD WORLD SCIENTISTS AND THEIR ORGANISATIONS

Mohamed H.A. Hassan
Executive Director, Third World Academy of Sciences (TWAS)
Secretary General, Third World Network of Scientific Organizations (TWNSO)

Unify, unite, join, organise, network, mobilise ... these are the words that characterised the life and work of Professor Abdus Salam, both as a physicist and a promoter of science and technology in the developing world.

The foundation of the Third World Academy of Sciences (TWAS) was a result of his intense passion to mobilise and unite the most distinguished scientists from the Third World for the purpose of promoting scientific excellence and utilising it for the benefit of the South.

It all began in October 1981 when Salam was attending the general meeting of the Pontifical Academy of Sciences in Rome. He and eight Pontifical Academy members from developing countries discussed his proposal of establishing an academy involving the most distinguished leaders of science in the South. They all agreed on a joint memorandum and the dream was left to Salam to transform into reality. He first started by identifying the most eminent scientists from the Third World who had already attained international recognition and invited them to become Founding Members. In March 1983, I received a letter from Salam inviting me to spend six months at the ICTP to assist in various matters, including the organisation of the foundation meeting of TWAS. Since then, I had the great honour, privilege and good fortune of being closely associated with Professor Salam for a period of over 12 years. Working with Professor Salam was a thrilling and fascinating experience. It was difficult to catch up with him at times, as he was constantly innovative; but always exciting, stimulating and educational and I cherished every moment of it.

The foundation meeting was successfully held in Trieste in November 1983 and Professor Salam was unanimously elected as Founding President of the Academy. The Founding Members were 41 (including all the Nobel Laureates in science of Third World origin).

A generous grant of US$ 1.5 million from the Italian Ministry of Foreign Affairs enabled Salam to organise a major conference in Trieste in 1985 to launch the Academy's programmes. He invited the Secretary General of the United Nations to inaugurate the event in July 1985.

Within a short span of time, Professor Salam transformed TWAS into a world-wide premier organisation that gives recognition to the outstanding achievements of Third World scientists, that supports and encourages the pursuit of scientific excellence in the South and that promotes South-South co-operation between individuals and centres of scientific excellence.

The next substantial step undertaken by Salam in his untiring efforts to improve the status of science and technology in the South was the establishment in Trieste in 1988 of the Third World Network of Scientific Organizations (TWNSO). Through TWNSO, Salam united the leading scientific organisations in the South, including national academies, research councils and ministries responsible for science and technology. This ingenious initiative enabled TWAS to have a strong and effective political arm in developing countries and to address broader issues related to government funding for science and technology and science policy and management.

In conjunction with the 1988 TWNSO meeting, an important meeting of Third World women scientists was also organised by TWAS which led to the establishment of the Third World Organization for Women in Science (TWOWS). The President of this organisation, Professor Lydia P. Makhubu, present here today, will tell you more about TWOWS later.

But it had always been the political will and political commitment by the leaders in the South to support science and technology that Professor Salam considered most crucial. He wrote in one of his articles: "It is a political decision on the part of those (principally from the South) who decide on the destiny of developing humanity if they will take steps to let 'Les Misérables' create, master and utilise modern science and technology."

In 1989, the former President of Tanzania, Dr. J. Nyerere, invited Professor Salam to become a member of the South Commission which was established by the G-77 under his chairmanship. Although he was the only scientist in the Commission, Salam was able to get the message of science and technology included in almost every chapter of the celebrated Commission's report published in 1990. In a message sent to TWAS last year, President Nyerere wrote:

"Abdus Salam was a very special human being, who combined a commitment to pushing forward the frontiers of science with a deep sense of responsibility to the countries and people of the developing countries. The South Commission Report would have been very different — and much less useful — without his contributions to the many discussions held and his constant reiteration of the importance of promoting the development of Science and Technology within developing countries. "

In 1990, Salam became fascinated by the Consultative Group on International Agricultural Research (CGIAR) network of about 16 international centres in agricultural sciences located in different countries in the South, and supported by the World Bank and a group of international funding organisations with an annual budget of about US$ 300 million. He developed a project to set up a similar network of 20 international centres of excellence in various fields of applied science, technology and environment modelled on the ICTP. "If we can have such a network of international centres of excellence established in Third World countries, we will not only be able to stop the massive exodus of scientific talent to the North but also link science and technology to production sectors," he said.

In 1991, I accompanied Professor Salam to the World Bank where he tried to "sell" his 20 centres project to the hard-line economists who, with their short-term adjustment policies, were hardly sympathetic to Professor Salam's long-term vision of science-led development. He was advised, however, by the Bank officials that he should seek the support of the heads of governments and ministers of finance in the South for this project. That prompted Salam to mobilise the political leadership in developing countries under "a commission of heads of state or government in the South" to support his project. The Commission (named COMSATS) was formed in 1992/93, and 19 heads of state or government agreed to join it. Professor Salam invited the Prime Minister of Pakistan (his own country) to chair the Commission and organise its first meeting. The meeting was successfully held in 1994; but unfortunately, Salam was not well enough to travel to Islamabad to attend it. The meeting, however, paid a very special tribute to him and to what he had done for the Third World. It endorsed Professor Salam's project of 20 centres and agreed to establish the Commission's secretariat in Islamabad, with an initial endowment of US$ 1 million donated by the government of Pakistan.

Salam's last endeavour before he became ill was to bring the economists and the ministers of finance and planning on board his science-driven development ship. "When it comes to the allocation of funds for science and technology, the ministers of finance and planning are most important, even more important than heads of government in many of our countries," he once said to me and his old friend Augustin Papic of Yugoslavia.

In April 1992 Professor Salam, Dr. Emmerij, the eminent economist and former president of the OECD Development Centre, and Ambassador Papic convened a meeting in Trieste involving a number of internationally renowned economists and an equal number of leading scientists to address what Salam called "the missing links between scientists and economists". In his opening speech he said: "During the course of our discussion on the issue, Papic and I asked the question of who were the enemies preventing the use of science and technology to achieve development in the South. We concluded that there were two of them. The first were the economists and the second were the scientists themselves, who were not their own friends. We blamed the economists and planners for not paying attention to long-term science-led development policies and we equally blamed the leading scientists for not trying hard enough to understand the economists and to get involved in solving practical problems." "A new strong alliance between these two breeds is necessary," he concluded.

I just gave you a quick overview of the remarkable contributions made by this legendary figure, Abdus Salam, to the organisation, development and utilisation of science for the benefit of the Third World over a short period of ten years (1983-1992). The best tribute we can pay to his memory today, one year after his passing away, is to strive to fulfil the aims of the three monuments he has bequeathed to us: ICTP, TWAS and TWNSO, and to ensure that his tireless efforts of empowering the poor with knowledge, science and technology to enable them to overcome chronic developmental problems and further marginalisation will be continued.

MOHAMED HAG ALI HASSAN is a former Professor and Dean of the School of Mathematical Sciences of the University of Khartoum, Sudan, and is now Executive Director of the Third World Academy of Sciences, Secretary General of the Third World Network of Scientific Organizations and President of the African Academy of Sciences. Professor Hassan was an Associate Member of the ICTP from 1976 to 1983 and has been involved in the organisation of several courses at the Centre. He was one of Abdus Salam's closest collaborators.

THIRD WORLD WOMEN SCIENTISTS

Lydia Makhubu
President, Third World Organization for Women in Science

I am profoundly honoured by the invitation to address the memorial meeting in honour of the late Professor Abdus Salam, Nobel Laureate, founder of the International Centre for Theoretical Physics and founder President of the Third World Academy of Sciences.

I had heard of Professor Abdus Salam long before the October 1988 Conference on the Role of Women in the Development of Science and Technology in the Third World which was convened in Trieste by the Canadian International Development Agency (CIDA) and the Third World Academy of Sciences (TWAS). This conference was a landmark event which was attended by some 250 of the most outstanding women scientists of the Third World and by two women Nobel Laureates, Professor Dorothy Hodgkin and Professor Rita Levi-Montalcini from the North. It was at that meeting that I had the privilege and honour to meet and hear Professor Salam express in simple and even anecdotal but convincing language the idea of forming an association for Third World women scientists. He gave a brief account of the origin of the idea from Ronald Leger, then Director of the International NGO Division of CIDA, and how his idea was subsequently adopted at the TWAS bi-annual meeting in Beijing in 1987.

In his address, Professor Salam narrated his personal encounter and experience with the dilemma of women in science when his brilliant daughter, Dr. Aziza Rahman, obtained a PhD degree in Biochemistry from the University of London and went on to do research at the Cancer Institute of Columbia University in New York. What began as a brilliant scientific career for Dr. Rahman was subsequently interrupted by marriage when she selected to raise her family rather than continue as a scientist. This, ladies and gentlemen, is a typical story for women in science and those in academia — women aspiring to intellectual leadership in the Third World and elsewhere in the world. Ladies and gentlemen, I do not regard this typical story as a sad story but rather as one which highlights the important role of women in human development, social stability and cohesion, without which societies would crumble.

In suggesting the formation of an association of women scientists in the Third World, Professor Salam and others like him were seeking ways of enabling women to accommodate their crucial social responsibilities without depriving humanity of what I believe is a unique contribution to science that only women can give. There have been diverse opinions regarding the potential contribution of women in giving direction and emphasis to the international scientific endeavour. Some have felt that male domination of science and technology has resulted in the devotion of resources to scientific research related to military superiority rather than to areas such as the environment, food production, population and other spheres related to the improvement of the quality of life of the majority of people, especially in the Third World. They also have strongly posited that greater involvement of women would lead to enhanced emphasis on the use of science to address basic needs of humankind. Whatever position is expressed, there can be no doubt that humanity is poorer with the gross under-representation of women in scientific activities. That women constitute slightly over 50% of the human population is indicative of nature's balance which should be reflected in all human endeavours that affect all aspects of human life in a far reaching and fundamental manner.

The Third World Organization for Women in Science (TWOWS) was a product of these considerations. Its overall objective is to promote the participation of women in the scientific and technological development of their countries, with specific reference to linking high-level scientific activities to grassroots concerns.

Professor Abdus Salam was a Nobel Laureate in physics, an area in which women are often grossly under-represented. This did not deter his sharp mind from appreciating the need to help women transcend socio-cultural barriers and join the international scientific community. His support for TWOWS was clearly evident at its founding in 1989 and has remained steadfast over the years. TWAS has fully supported TWOWS, thus enabling it to run a credible programme that has attracted the participation of women scientists from all parts of the world.

The women scientists of the Third World honour Abdus Salam's memory. We salute him for his foresight and dedication to the advancement of science and technology in the Third World and for his deep concern for their application and effective use in order to improve the quality of human life. His ideas on this subject will remain a crucial cornerstone in all endeavours by women scientists to participate fully in the advancement of science and, more so, in those scientific pursuits which aim at improving the lot of humankind.

LYDIA MAKHUBU is Professor of Chemistry with a PhD from the University of Toronto. She has been Vice-Chancellor of the University of Swaziland since 1988. Over the years, she has been an active consultant for numerous international organizations and commissions. Professor Makhubu is President of the Third World Organization for Women in Science. She is the holder of the UNESCO and Association of African Universities Chair for Women in Science and Technology in Africa.

SESSION IV

Chairman: Saeed Durrani

Nigel Calder
Munir Ahmad Khan
Pervez Hoodbhoy
Nguyen Van Hieu
Asghar Qadir
Imran Saadi
Umar Salam
Ahmad Salam
Mirza Tahir Ahmad

ABDUS SALAM'S COSMIC ANGER

Nigel Calder
Science Writer, United Kingdom

I admire your stamina. I am almost number 30 of the speakers you have heard today. As a father and grandfather, I am most astonished by the stamina of the children of the Salam family. I don't know where they get it from. Not, I think, from Abdus Salam. We've heard that he was not the most patient of men.

My problem was whether there would be anything left for me to say, and I am relieved to find that there is. It is not just a matter of picking up on other people's anecdotes, although Gordon Fraser, after dinner last night, was talking about Abdus Salam's very short-lived career in experimental physics. As I understand that phase of his life, what really annoyed the experimentalists at Cambridge University was not that Salam kept getting bad results, but that he kept inventing new theories to explain why his bad results were correct. Gordon mentioned Salam's own explanation, that he lacked the patience to be an experimentalist. But I want to suggest that in a certain cosmic sense he was a patient man.

In my many encounters with him as a science writer, I remember him as a patient teacher of stupid journalists. I recall that at Geneva in 1958 he took time off from a busy United Nations conference to explain parity violation to me, over a cup of coffee. At a more critical time, in 1976, I was doing a big programme about particle physics for the BBC and other broadcasters, and I was in a fix. I had sold this idea to the broadcasters and I didn't understand the subject. A science writer cannot explain science to the general public unless he or she grasps the concepts fairly deeply.

Fortunately Salam was in London; unfortunately he was extremely busy. "I can have a quick lunch with you," he said. So in the senior common room at Imperial College I tried to extract from him an understanding of what we now call the electro-weak force. Over coffee, we still were not getting very far, and Salam went to make a phone call. He came back and said: "Now I have some more time."

We went round the course again and again. It was about half past three in the afternoon and I wasn't getting there, although I desperately needed to understand. I have a vivid memory of saying to him: "Yes, you say that a photon can turn into an electron and a positron ..." and he said: "No! I say a photon IS an electron and a positron." At that moment the scales dropped from my eyes and at last I understood what he was driving at.

We have heard many key words today about Salam: about his laughter, and the delight that surrounded him, about his generosity, about his passion and his power. I want to offer you another word which goes deep, I think, into his personality, and that is his anger.

I often saw him angry. I don't mean in a petty sense of getting cross with somebody who had annoyed him. I mean a sort of cosmic anger. He was, for example, deeply proud of medieval Islamic science, but angry about the way it had declined, and about how difficult it was to revive. He had a special anger for world poverty. He would put down a newspaper and almost shout at me about the wickedness of the terms of trade that were turning adversely against the Third World, and were thereby wiping out everything that was being given by way of aid and technical assistance.

Salam knew that it was an accident of history that, in the 17th century, the scientific revolution occurred in Europe. And in the 18th century the industrial revolution also took place in Europe, with the consequent division of the world into two. In 1991, Salam said at a conference of the International Council of Scientific Unions: "I have long maintained that this globe of ours is inhabited by two distinct species of human beings; the developed and the developing, the rich and the poor. What distinguishes one type of human from the other is the ambition, the power, the *élan*, which basically stems from their differing mastery and utilisation of present day science and technology."

He often said: "We know the world has enough resources, technical, scientific and material, to eliminate poverty, disease and death for the whole human race." In 1964, when I was editing *New Scientist*, I invited 100 leading scientists and scholars from around the world to cast their minds twenty years forward. Was science leading us towards heaven or hell? One of the very first replies that I published was from Salam, and he took a rather pessimistic view. He thought that the big divide that he saw would continue, as indeed it did.

He also wrote this: "Never in the history of mankind has a change happened all at once. The one great change of the first half of the century, the passing of the colonial age, was the culmination of 50 years of crusading. In most places it started with a few men whose passionate fury first overwhelmed their own peoples and then succeeded in rousing the liberal conscience of their captors, bringing home to them also the utter economic futility of holding down an unwilling people. This is the normal process of change."

Salam continued: "What makes me worried is that no such thing has yet happened in the underdeveloped world as far as the harder crusade against poverty is concerned. And in the few places where realisation has come, it has not been purposeful enough yet to bring down the internal social and organisational barriers, nor to be able to defy external pressures. In the next twenty years I trust this crusade will come to be preached with the fury it deserves."

You will understand from his prose why he was torn at one time between following a career in science or a career in English. And Salam's sense of history gave him his cosmic patience, in contrast with his superficial impatience in everyday matters.

How can we express his fury about the division of the world in a modern, practical fashion? All of us in this room know what he did. We are celebrating him and we know his spirit lives. Among physicists world-wide, his memory is well preserved; also in Pakistan where so many turned out for his funeral. But amid our euphoria, and our happiness in remembering his achievements, don't forget this. If you asked an ordinary person in the street, in London, or Berlin, or San Francisco, or Rio de Janeiro, or Accra, or Jakarta, "Who was Abdus Salam?" they wouldn't know.

What can we do about that? Salam was a romantic and I am a romantic. I believe that human beings by taking thought can change the world. Let me mention another romantic story. Marie Curie came from Poland, which was not renowned for its science at that time. She became a world-famous scientist and won the Nobel Prize earlier in this century. I am sure that Lydia Makhubu will agree that the example of Marie Curie was an inspiration to young women in many countries to dare to become scientists in a male-dominated profession; Dorothy Hodgkin, for example, was mentioned.

That leads me towards my main point. Professor Bambah and Professor Durrani have spoken of the childhood and adolescence of Salam in

Jhang and Lahore. Professor Badran told of the amazement that someone from the Third World should win the Nobel Prize in physics. Here is a wonderfully romantic story of a young lad in a turban from a market town in the Punjab, that nobody had ever heard of, who became a leader of physics and faced up to politicians as a champion of the world's poor. He wore the same kind of turban as he had worn as a child, to collect his Nobel Prize from the King of Sweden.

The thought I want to leave with you is that his story should be told to every child in the Third World. As a professional communicator I don't know what the ideal means would be. Perhaps a book in strip-cartoon format which could be translated into many languages, perhaps a film or a video. But the story will inspire young people with the idea that, wherever they come from in the world, they too can make careers in science — or indeed in any other profession at present dominated by the rich countries.

NIGEL CALDER is a science writer. He first met Abdus Salam nearly forty years ago when he was a staff writer for *New Scientist*. He continued to consult Salam when he became Editor of *New Scientist* and, afterwards, as an independent writer when scripting TV "special specials" for the BBC and other broadcasters.

LIFELONG FRIENDSHIP WITH ABDUS SALAM

Munir Ahmad Khan
Former Chairman of the Pakistan Atomic Energy Commission

It is a matter of great honour for me to be invited this afternoon to join in paying a tribute to Professor Salam both as a Pakistani and a friend of Salam. I feel proud and grateful that you have decided to rename the centre after him as a living monument to his memory. While the Centre was conceived by Salam, it would not have succeeded without the generous and continuing support of the Italian Government, the International Atomic Energy Agency, the United Nations Educational, Scientific and Cultural Organization and the collaboration of the physics community and friends around the world. They all deserve our sincere gratitude.

We have already heard about his remarkable achievements. He was a monumental figure of our time who operated on the world stage in different roles. He was not only a scientist but a visionary who conceived and built great institutions and temples of science; a patriot who served his country well; a servant of the Third World who infused a spirit of confidence and hope among the scientists of the developing countries and above all a true cosmopolitan who brought North and South and East and West closer together. So many around the world owe him so much that we cannot repay our debt to him. I shall not repeat what my distinguished friends have already said before but I shall touch upon a few aspects of his life that I knew something about.

I met Salam as a contemporary in the Government College Lahore in 1942. I could have met him four years earlier in the Central Model School Lahore. However, after having been selected for admission, the headmaster quietly advised his father to take him back to Jhang because the boy was wearing a red Fez cap and the other students might make fun of him. It was advice which the headmaster lived to regret. My association with him continued until the very end. He was already a legend for his academic achievements when he came to Lahore. We fought the College Union elections together in 1945 but he won as President and I lost as Secretary. He was a rare combination of literary and scientific talents and a natural leader. He also became the Chief Editor of the College magazine.

It seemed that fate was guiding his career for he nearly got derailed on many occasions. Having stood first in English and Mathematics his tutor wanted him to become an English teacher but I suspect he felt that he could play chess better by sticking to Mathematics. In those days of the Raj the highest aspiration of a young man was to become a civil servant in His Majesty's Service. He nearly got into the Indian State Railways but fortunately failed in the medical test because he wore spectacles at an early age which saved him from becoming an engineer like myself and saved the Railways too because he was no mechanical genius. His father wanted him to join the famous Indian Civil Service. In 1946 he was one year too young to compete. If he had become a civil servant he would have been lost to both science and humanity. His admission to Cambridge was also a happy accident. His father who was a senior clerk in the education department in Jhang was too poor to send him abroad but he won the "Peasants Scholarship" and his admission in Cambridge took place at the last minute when an unexpected vacancy fell in St. Johns College under Dirac. He sailed for Cambridge from Bombay in September 1946 after escaping arrest as a suspected deserter from the Navy, even though he had never seen the ocean before. The ship which carried him had 600 Italian prisoners of war sailing back home. This perhaps explains his affinity for Italy and its cuisine. When he landed at Liverpool on a cold morning he was shivering. Sir Zafarullah Khan, his mentor, was there to rescue him and lent him an overcoat. In those days Cambridge had no central heating and he acquired the habit of being overdressed all the time. This explains why we often saw him wearing a topcoat even in the summer because he was perpetually cold.

For a boy from Jhang who had not seen electricity until his teen years, Cambridge demanded great adjustment. He did it by wrestling day and night with mathematical problems and finished his Tripos in two instead of three years. Fred Hoyle advised him to spend a year at Cavendish Lab to do some experimental physics. But Salam had no patience for laboratory work, as his hands could not keep up with his imagination. After graduating, he made a brief trip to Pakistan and got his "Peasants Scholarship" renewed at Cambridge but he made sure that he never entered Cavendish again.

While doing his PhD another happy accident occurred. When he was challenged to solve an intractable problem within one year which had defied such great minds as Dirac and Feynman he found a solution for the renormalisation of meson theory within six months. From then on, he caught the fancy of such great men as Dirac, Bethe and Oppenheimer. Upon his return to Pakistan as a famous scientist he was rewarded by being made Head of the Mathematics Department at the Government College and President of the Football Club at the same time. He soon found that the two did not mix well and the situation was unmanageable for him. He felt cut off from the mainstream of international physics and this "forced" isolation choked his genius. Although he loved Pakistan he could not live a life of physics there. This inner struggle left a deep imprint on him. Later on in his life, he could relate himself fully to the anguish of isolation which stifled the flowering of many gifted scientists of the Third World who could not grow because they were unable to interact freely with active research centres and felt left out. He became more troubled after the communal disturbances in Lahore in 1953 in which his small religious community was targeted. Under these circumstances he felt he could not resist an offer of being a lecturer at Cambridge. Although he left his homeland for good in 1954, his heart always belonged to Pakistan.

Salam and I were out of touch between 1951 and 1958 when I was in America. But we resumed our association when I joined the International Atomic Energy Agency (IAEA) in 1958. We found we had many things in common. But unlike him my first love was not theoretical physics or even mathematics. He regarded nuclear fission and nuclear power as "passé" as it had already "happened". However, we had a common interest in the development of science and technology in Pakistan and the Third World. Also, he wanted someone to talk to in Punjabi, to share his vision of a grand design to rescue science in the developing world; to share his hope and fears and his disappointment and frustrations at not being appreciated at home and even rejected by those he loved most.

One morning in September 1960 he came to my office in Vienna, lamenting the fact that the Agency was not doing enough for the developing countries. He said he had a wonderful idea to set up a centre for theoretical physics under the IAEA. It would cost very little — just pencil and paper — but could be a meeting place for the East and the West and help break the isolation of physicists in the developing countries. He wanted to see someone in the Agency to push this idea further. I called up Professor Seligman, Head of the Research Department in the Agency and he asked me: "Who is Professor Salam?" When I told him that Salam was the youngest Fellow of the Royal Society and a Professor at the Imperial

College his tune changed. Later Salam and Seligman became good friends but poor Seligman could not live down his *faux-pas* for the next thirty years. Salam made his proposal for the establishment of the International Centre for Theoretical Physics (ICTP) before the General Conference but met with strong resistance from the advanced countries. The Agency's Scientific Advisory Committee, which included Nobel Laureates like Rabi, unanimously opposed the idea. But Salam was not willing to give up. He marshalled the support of the leading theoretical physicists from all over the world. Dr. Eklund, the Director General of the Agency, supported him. Finally the Board of Governors and the General Conference overruled the Scientific Advisory Committee. That is how ICTP came into being.

I remember the day he came to Vienna to plead for his Centre before the Board. He landed at the airport dressed in his topcoat and a canvas hat which was not only discoloured but rumpled out of shape. I was horrified to see him in that attire. I persuaded him to take his coat and hat off which I deposited in the trunk of the car. Between the airport and the Bristol Hotel I managed to make the hat disappear. When he reached his hotel room he started looking for his hat. I carried out what appeared to be a strenuous search. Then I reminded him that he had to rush to the Board meeting and the search for the hat could be resumed later on. He accepted the logic of it. He was very eloquent before the Board. At the end of the debate Professor Smythe of Princeton University, who was Governor from the US on the Board, remarked "A large number of Member States support the ICTP. So does Professor Salam and he is equal to several Member States". There was laughter. The issue was clinched and the Centre formally approved in 1964.

Salam was a deeply religious man who saw no contradiction between science and religion. He believed that pursuit of knowledge was a form of prayer and God enjoined upon his followers to seek knowledge and discover the secrets of his creation. Only one spirit permeated the entire universe and held it together and all forces emanated from the same source. That underlined his faith in the eventual unification of all forces. But he believed that science should not be pursued for the sake of science alone. It had to be put to use in the service of man which represented the highest creation of God. He wanted to employ scientific knowledge for the uplift of men and for accelerating the economic and social development of the Third World. This explains why he expanded the scope of the ICTP from theoretical physics to cover many applied fields such as computers, electronics, chemistry, energy, environment, biotechnology and so on. Today Trieste is fast becoming a Science City with numerous institutes which have sprung around the ICTP.

Salam was not only a servant of science but a servant of the Third World. He awakened the developing countries to the crucial role that science had to play in their development and survival. He fired the imagination of many Presidents and Heads of Government and policy makers throughout the world to build scientific institutions. But his greatest legacy is the brain power that he developed. Thousands of scientists from the Third World have come to ICTP to be inspired by his vision and go back charged with zeal and enthusiasm to light the torch of knowledge in their respective countries. As C.P. Snow said: "Few have done more for the talented poor and underprivileged of the Third World than Salam." In the difficult years of the Cold War he brought together the physicists from the East and the West and built a bridge of science which served the world so well.

Though Salam lived abroad, he rendered invaluable services to Pakistan in the development of science and technology and remained as the Chief Scientific Advisor to the President and a member of the Pakistan Atomic Energy Commission for 14 years. He guided us in building our atomic energy programme from its very inception and helped in the setting up of the first research reactor and acquisition of the nuclear power plant at Karachi. He encouraged the Government to train scientists abroad, many of whom are present here as leaders of science in Pakistan. He was responsible for initiating our space research programme. He obtained help from abroad to solve water logging and salinity problems in the country. He prepared a master plan for the promotion of science and technology. He gave us the idea of starting the Nathiagali College on Physics and Contemporary Needs which has held meetings over the last 25 years. He very much wanted that we should establish a Centre for Physics in Pakistan which should work closely with the ICTP. I hope we will translate his dream into reality in the future. For us Salam was an inspiration and a window to the world of science which we have lost with his departure.

I had the privilege of hosting Salam's visits to Pakistan over a period of about 15 years which included calls on our presidents and prime ministers where he pleaded the cause of science. His ultimate desire was to retire in Pakistan and help build a new generation of young physicists in the universities. He remained a Pakistani until the very end. When he went to receive the Nobel Prize in Stockholm he made sure that he was dressed in his native costume including the golden "khusa" shoes and a village turban. Incidentally he had forgotten how to tie his turban. The curious work of art reflected in his headgear at the Nobel ceremony was the creation of the cook of the Ambassador. But he wanted to underline the fact that he had not forgotten his roots and was proud of his rural background of a backward town of a developing country.

My last detailed meeting with Salam was in 1992 at Trieste. His health had started to fail. I remember that he insisted on climbing the stairs to his villa unaided. The following day he made breakfast for me which we ate in the kitchen while he talked about the future. He said he was working on applying the principles of physics and mathematics to biology for obtaining further insights into the origin of life. He was not satisfied with unifying two of the four elementary interactions. He was developing a new hypothesis about the origins of homochirality of some of the molecules of living organisms on earth, in particular the protein aminoacids. If he had lived longer he would have contributed more to our knowledge about the origin of life and how its character was determined by the weak interaction which violates parity.

I saw him only three months before his death at his residence in Oxford. I told him how we had celebrated his 70th birthday in January 1996 and the tributes which were paid to him throughout Pakistan. He listened to me but could not respond. He just stared at me as if he had risen above praise. As I departed he pressed my hand feebly as if to ask me to convey his thanks to all those who had said kind words about him.

People often ask me: "Will Pakistan produce another Salam?" I do not know whether this will happen or not but one thing I am sure about. From among the thousands of young scientists whom he has inspired through their visits to Trieste and by his exhortations around the world there will be many who will follow his path. I believe that in the next century some new Nobel Laureates will come from the Third World who will be disciples of Salam.

Salam was a colourful and complex man with many personalities in one. He had many pursuits, passions and interests. He was both a visionary and a builder. His life's work can be summed up in one couplet of the Poet of the East, Mohammad Iqbal, who said:

Your world is not the world
of bricks and stones you see around
Your world is the one
which you create yourself.

He certainly created a world of his own, full of cities of science with citadels of learning where thousands of devotees come year after year to discover the secrets of nature. This Abdus Salam ICTP is but one manifestation of the new world Salam created.

MUNIR AHMAD KHAN, a nuclear engineer, was Chairman of the Pakistan Atomic Energy Commission from 1972 to 1991, a Member of the Board of Governors of the IAEA for twelve years and its chairman from 1986 to 1987. As an associate of Abdus Salam from college days, he worked closely with him in evolving the concept of the ICTP and its approval by the Agency. He was Scientific Secretary of the 1964 and 1971 UN Geneva Conferences on the Peaceful Uses of Atomic Energy. In the recent past he has been a member of several international committees dealing with the development of nuclear power and of science and technology. He was actively engaged in nuclear disarmament and in non-proliferation programmes at the regional and international levels. Munir Ahmad Khan passed away on 21 April 1999.

UNFULFILLED EXPECTATIONS – ABDUS SALAM AND SCIENCE IN PAKISTAN

Pervez Hoodbhoy
Quaid-i-Azam University
Islamabad, Pakistan

Very properly this memorial meeting is to honour Professor Abdus Salam for his spectacular achievements, both as a physicist and for having created this Centre, now a focal point for scientific development in the Third World. It is a historic moment that, from today, the Centre shall be known as the Abdus Salam International Centre for Theoretical Physics. I cannot think of any great physicist in this century who has been honoured at a comparable level.

It is, therefore, with considerable hesitation that I have chosen to talk not about Salam's brilliant successes but, instead, his most spectacular failure, by which I mean his unfulfilled quest to bring science to Pakistan and other Muslim countries of the world.

Three reasons compel me to talk about unpleasant matters in a meeting where so many pleasant things have been said over the last three days.

First, Salam was passionately committed to the idea that the cultural and material improvement of society hinges critically upon its developing science. He wished this for all countries, but did so with special intensity for the country of his birth. Hence, to let his unfulfilled expectations pass without comment would be a significant omission.

Second, Salam's failure does not take away from him or make him a lesser person. Rather, it forces us to confront the question: what went wrong? It particularly demands that those of us who live in Pakistan ask why scientific and social development in our country continues to elude us, and why it appears an even more distant goal than it was 30 years ago. To my mind, telling the truth now — harsh though it be — may well be the only way of avoiding tragedy in the future.

Third, it is almost entirely in the context of Third World scientific development that I got to know Professor Salam. Over a period of many years, I had the privilege of engaging with him in numerous discussions and correspondence. I first met him as an awe-struck undergraduate student at MIT in 1972, and then as a visitor to the Centre in 1978. However, these were non-events. He did not know me then, or, for that matter, need to know. It was in 1985 that I was pleasantly surprised to receive a letter from him in Islamabad, where I was (and am) teaching, saying that he had read my critique of orthodox Islamist attempts to create an "Islamic Science" and the role of religious intolerance in destroying Muslim intellectual achievements many centuries ago. He suggested that, should I visit the Centre, he would like me to call upon him.

I can, therefore, date my association with Professor Salam to the summer of 1985. The following year he suggested that we jointly author a preface to Michael Moravcsik's book *On the Road to World-wide Science,* the manuscript of which he had just received. I was proud to accept. Two years later Salam wrote the introduction to my book *Islam and Science – Religious Orthodoxy and the Battle for Rationality.* In his essay he makes perfectly explicit that the validity of a scientific truth can be adjudicated only according to criteria internal to science and not by appeal to religious, metaphysical, or aesthetic considerations. I am happy that my book provided Salam a vehicle to clearly articulate his views because much confusion had existed about where he stood on the issue of religion and science.

The previous speaker detailed some of the ways in which Salam used his talent, time, prestige, and power to raise the level of scientific development in Pakistan. As the scientific adviser to the President of Pakistan, Salam was responsible for laying the groundwork for the Pakistan Atomic Energy Commission, initiating research on problems of waterlogging and salinity, and agricultural research. He was the role model for many of those who opted for careers in science. To all this I may add that his personal generosity was simply extraordinary. He supported poor students in various cities of Pakistan and bought scientific equipment for schools and colleges with his personal funds. He laid aside part of his Nobel Prize money for a yearly prize to be awarded to the best researcher in a scientific field. And, I am witness to the pile of letters on his desk, received from students and admirers. Since time is the most precious and scarce resource for a busy and productive person, it always amazed me that Salam would reply to almost all of them, even the silly ones.

So, you might expect that Salam would be a hero in Pakistan. Not so!

Right here we have the biggest, by far, theoretical physics institution in the world now named after Salam. But, in the country of his birth and citizenship, no scientific or other institution, building, or even a street, bears his name. School textbooks do not mention him, nor are children told about him by their teachers. Fake heroes are spattered all over the place but Salam is never to be found. Reflecting the disdain felt by much of Pakistani academia, a former vice-chancellor of my university scornfully asked in a meeting: "Who is Salam? What has he done for Pakistan?".

It is a fact that Salam had easy access to most world leaders, UN high officials, the Pope, and others, but found it very difficult to be heard by the leaders of his own country. In 1988 I was in Professor Salam's hotel room in Islamabad where he had been patiently waiting for two days to meet with Prime Minister Benazir Bhutto. I took advantage of this to discuss his participation in a TV programme on educational problems that I was preparing. It was not right, I thought to myself, for a person of his stature and ill-health to be kept waiting in this manner. Suddenly the phone rang and Salam's face momentarily lit up. Then I saw his face fall as Benazir Bhutto's secretary told him that meeting had been called off. No reason was given. Yes, I am glad that Prime Minister Nawaz Sharif was gracious enough to send a message of congratulation today at this meeting. We must always be grateful for small mercies. But how much did that cost? I can recall that, about five years ago, while addressing a convocation at Government College Lahore, Mr. Sharif named all the illustrious alumni of the College but did not consider Salam worthy of mention!

It is remarkable that, about a decade ago, Professor Salam wanted to be in the running for the position of Director General of UNESCO but Pakistan refused to endorse his candidature. This was in spite of the fact that several developing countries, particularly Jordan and Kuwait, had pledged to fully support him. Since Salam had never given up his Pakistani nationality, the lack of endorsement by his home country killed his candidature.

Apart from being ignored and denied by officialdom, Salam was also the target of bitter attack and vilification as well. Right wing magazines concocted wild conspiracies of nuclear espionage, claiming that he had sold nuclear secrets to India. Fundamentalist student groups made it impossible, or very difficult, for Salam to visit any university campus. I am ashamed to say that Salam could never set foot in my university in Islamabad, whose physics department had been inspired in considerable part by him, and which was the only department in the country where his lectures could be possibly understood.

So much for Pakistan. And what of the Muslim countries which Salam endlessly cajoled, persuaded, and repeatedly visited for over three decades in the hope of prodding them along the road to scientific progress? He had many ideas and, in particular, a grand scheme to bring science to these countries by putting together an Islamic Science Foundation, with an initial endowment of $1 billion, pooled together by a consortium of Islamic countries. It fell flat on its face after Saudi Arabia pulled out and Salam, together with his co-religionists, was banned from ever setting foot on Saudi soil. Salam never complained about this or other matters publicly, but privately he would express distress and disappointment that only two countries, namely Kuwait and Iran, seemed to be at all interested in putting money into science.

I am sure that many people in this audience must be very confused about what brought about this situation. Allow me to explain.

Before 1974, Salam was legally a Muslim in Pakistan, but subsequently he became a non-Muslim in a state where non-Muslims are, by law, second class citizens. Subsequent to his excommunication by an act of the Pakistani national parliament, and of his Ahmadiyya sect, Salam resigned as Adviser to the President. Although he maintained informal contacts with the government, scientific institutions, and individuals, in effect he ceased to exercise significant authority.

Salam never accepted this excommunication. It clearly drove him into becoming more religious. Regrettably so, in the opinion of some, but that is not for me to comment upon. Subsequently (I think), he developed an intense pride in his heritage and did what no one else — Muslim or other — had done. From dry and dusty history books he rescued the scientific and intellectual achievements of Muslim intellectual giants of a thousand years ago and turned them into symbols of cultural pride. The crucially important thing is that he emphasised these achievements as belonging to the realm of the rational. For example, it is from one of Salam's essays that I first learned of the 12th century Arab scholar, Ibn-al-Haytham, long forgotten by all except professional historians, who had anticipated Fermat's principle of least action applied to light. Similarly, Salam's lecture, delivered in Stockholm at the Nobel Prize ceremony, begins with the journeys of Michael the Scot who travelled to Toledo in Muslim Spain, searching for learning and knowledge, all of which were then concentrated in the lands of

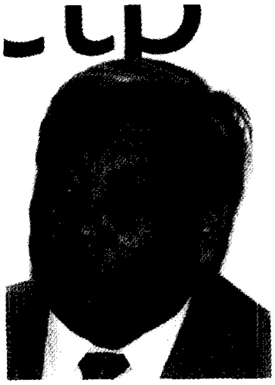
Islam. Salam's purpose was to rekindle a sense of pride and hope amongst those who had long lost both. He did succeed, but the victory was partial and temporary. No mortal can fight the forces of history, especially when they are oriented towards the past rather than the future.

To my mind, Salam was the mythical Sisyphus in human form. Condemned by Pluto to forever push a large rock up Mount Olympus, each time Sisyphus would labour his way to the top, the rock would roll all the way down and he would have to begin once again. Until his long and tragic illness left him incapacitated, Salam too was condemned into perpetually and painfully pushing his schemes for scientific development up the unyielding mountain of religious prejudice. The brutal fact is that Salam was squarely defeated in the end by the very side whose cause he so vigorously championed.

The excommunication of 1974 merits further mention. Certainly, the doctrinal differences between Ahmadiyyas and mainstream Muslims are not of the slightest concern to us here — they are just as arcane and impossible to resolve as the differences between, say, Catholics or Protestants or Anabaptists or Calvinists. It is usual, as in the Middle Ages of Europe, for theological disputes to be resolved by the use of force with the weaker side being exterminated or terrorised into fleeing. This is the legacy that every religion has left to mankind. To prevent the majority from slaughtering the minority was precisely the historical reason for the emergence of secularism in Europe. Tragically the Pakistani state moved the other way and became party to a theological dispute which had simmered for many years. As it turned out, 1974 was the first step down the steep slippery slope, the bottom of which is not yet in sight. More and more sects and communities are facing the threat of persecution and possible excommunication as the fires of religious extremism burn ever higher. To be quite honest, on the balance sheet of history, what happens to a particular individual is of scarce import. Therefore what really matters is not Pakistan's treatment of Salam, or even the persecution of this or that community, but the fate of Pakistani society at large.

Let me now conclude. With characteristic generosity of spirit, Salam chose to forgive and forget. He could easily have become very bitter but remarkably he chose not to go that way. Let us acknowledge and respect this. While Salam was never a cultural libertarian, he did believe that only liberal, tolerant, and pluralistic societies can advance scientifically and culturally. Therefore the best tribute to him would be for each of us, in our own way, to work towards building a global society which offers equal opportunity to all inhabitants of our planet, encourages diversity and creativity, and allows religious beliefs to be pursued without fear.

PERVEZ HOODBHOY is Professor of Physics at Quaid-i-Azam University, Islamabad. During his visit to the Centre in 1978, he discovered that Abdus Salam shared his concern for the slow pace of scientific development in Islamic countries and this led to numerous discussions on religion, science, development and the relation between them. Salam and Hoodboy co-authored the introduction to Michael Moravcsik's book entitled *On the Road to World Wide Science*. In 1989, Salam wrote the preface to Pervez's book on *Islam and Science — Religious Orthodoxy and the Battle for Rationality.*



VIETNAM'S DEBT TO ABDUS SALAM

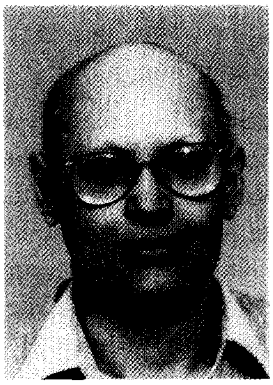
Nguyen Van Hieu
President, National Centre for Science and Technology of Vietnam

It is a great honour for me to be invited to attend this truly significant memorial meeting dedicated to a great man in the history of science, a great scientist, Abdus Salam, and to voice our thanks to him.

Dear friends, first of all I would like to express the profound gratitude of the Vietnamese physicists to Professor Abdus Salam and to ICTP for their great work in the Third World and, in particular, in Vietnam. Many young Vietnamese were trained in Trieste and are now members of the great scientific family of ICTP, created by Abdus Salam, the beloved great teacher and leader. For decades, senior Vietnamese theoreticians have admired the pioneering ideas of Abdus Salam and developed them in the unified gauge theory of electroweak interactions, in the relativistic theory of higher symmetries with non-compact groups, in the superfield formalism of supersymmetry and supergravity, in the Kaluza-Klein theories and many related topics. Through their success in these fields of high energy physics, there is now in Vietnam a genuine Abdus Salam ICTP School of Physics. Many Vietnamese physicists are very happy and proud to be the pupils of this school.

Dear friends, Abdus Salam passed away a year ago, but his name, his figure, his ideas and his great zeal will be living forever in the heart of the Vietnamese scientists. With great love for Abdus Salam, we bring from Vietnam a memorial souvenir, made with Vietnamese material in the tradition of Vietnamese art and painted by a Vietnamese artist. I would like to ask Professor Virasoro to accept it.

NGUYEN VAN HIEU is a high energy theorist who was trained in Dubna, former USSR. He has been the Director of the Institute of Physics in Hanoi and is presently President of the National Centre for Science and Technology of Vietnam. He has been a Fellow of the Third World Academy of Sciences since 1984.



SERVANT OF PEACE

Asghar Qadir
Quaid-i-Azam University
Islamabad, Pakistan

Abdus Salam — Servant of Peace. That was his name and that was his life. He dedicated it to the improvement of the Third World. His vision — a new paradigm for development — that science and its concomitant technology will alleviate the lot of the under-privileged nations by allowing them to leap-frog straight from the nineteenth to the twenty-first century. Not that he was a dreamer who expected there to be development without competition. He realised the importance of competition in pushing development forward at a more rapid pace. He encouraged competition — not in the sense of conflict, but in the context of co-operation. To him evil flourished through ignorance and was to be fought to the bitter end by knowledge. Science was to dispel this evil from the world. To him the development of science was a responsibility of the whole world, not only of the Third World. According to him, we were not pulling our load. He took on the responsibility of trying to help the Third World to struggle out of the darkness of ignorance and shed the light of science to dispel its problems.

Salam knew that he could not achieve his goal alone. He was perfectly ready to commandeer any and all people he could, to help him in his mission. He knew whom to request, whom to flatter into helping, whom to coax and cajole, whom to order and whom (like me) he could bully and brow-beat into doing what was needed. He demanded the impossible from his helpers in the enterprise of developing science in the Third World, but invariably still more from himself. His successes, like the Centre, are truly amazing, but he remained dissatisfied. There was always more to be done. His focus was not on what he had achieved, but on what remained to be done. I remember telling him very proudly of the development of my Department and his immediate response to that: "But what are you doing for the rest of the country?" He realised that there can be no stable equilibrium in development. If one does not go up one must come down. Now that he is no more, I myself can feel his sense of urgency about getting things done.

Though Salam's vision was for the Third World in general, he had a special soft corner for the Islamic World — and within that most of all for his homeland, Pakistan. He did what he could to motivate us Pakistanis to work for scientific development in Pakistan. I met him for the first time in 1964, when I went to the Physics Department of the Imperial College of Science and Technology (as it was then called) as an undergraduate freshman, and my career was greatly influenced by him and his advice. He was aware of the major problem of isolation faced by scientists in the Third World, and the enormous paucity of manpower there. He regarded it as imperative that Third World scientists diversify and cover more than one field, so as to reduce the problems of manpower shortage and isolation. This led to my pursuing research in physics, mathematics and economics, and in various areas in each of them. When I came to the ICTP for the first time in 1972 as a nearly fresh PhD and a new faculty member at the Islamabad University (as it was then called), he told me that it was my duty to see to it that other Pakistanis could benefit from it. I felt that it was unfair of him to ask that of me. How could someone so junior as I manage to make much of a difference? Following the usual plea of people in Pakistan, I said that he did not know how difficult it was to get anything done there, particularly for a non-entity like me. His answer was typical: "Do you think it was easy to build this Centre? Where do you think the money to run it comes from? Do you suppose it runs itself?" When I thought about it, I could see that it must have been well nigh impossible to convince the developed countries to support the Third World in developing basic science at the frontiers. It would be nearly as difficult to keep flowing the funds that enabled us to benefit from it. We did indeed have a responsibility to him to ensure adequate utilisation of the Centre to provide him with the basis to continue to extract support from elsewhere. I still felt that too much was being asked of a mere non-entity like me. Of course, Salam did not leave me to manage it all on my own. He provided the support to make me less of a non-entity. I later went on to work actively for proper participation in ICTP activities by Pakistani scientists. From there, it was a short step to getting involved with working for the development of science in Pakistan (to what extent I could).

When he received the Nobel Prize in 1979, he felt that he had won it, not for himself, but for the Third World. As such, he felt that he had no right to use the prize money for personal purposes but that it must be used to further his mission of development of science in the Third World. He specially put aside money to help Pakistan and Pakistani students. In 1980 he asked Professor Fayyazuddin, with my assistance, to formulate the rules and procedures for a prize to be awarded to young Pakistani scientists for their research in the basic sciences. Our suggestion was that the prize should be awarded annually by rotation for physics, chemistry, mathematics and biology to Pakistani nationals, normally resident in Pakistan, below 35 years of age on the 31st of December of the year for which the prize was to be awarded. It was to consist of a certificate giving a citation and a cash award of US$1,000. It was to be awarded on the basis of the collected research and/or a technical essay written specially for the prize. (My idea, in making the latter provision, was to allow for something like the Adams Prize as well.) To manage the prize a committee was proposed, consisting of the two of us and Professor Riazuddin. This proposal was approved by Professor Salam. Unfortunately, Riaz and Fayyaz both left the country and I was left to manage it on my own. I took to myself the title of Secretary of the Salam Prize Committee and proceeded to "manage" it. The first prize was for physics for the year 1981. It was to be awarded at the end of the year and fortunately Professor Salam himself was available to present the prize to the winner. I had dubbed the prize "the Abdus Salam Prize for Young Pakistani Scientists". As could have been anticipated, Professor Salam protested against the name for the prize. (This was at the ceremony to award the prize.) I was prepared for that, and put it to him that it enhanced the value of the prize to be associated with his name. The matter was put to the house, which gave overwhelming support for my name for it. As such it acquired that name then and has retained it since.

The Salam Prize has acquired a very high reputation. We have had some very notable winners. Among them is one of the speakers at this meeting today, Professor Pervez Amirali Hoodbhoy of the Department of Physics, Quaid-i-Azam University. There is Professor Suhail Zuberi (for his work in quantum optics), Chairman of the Department of Electronics, Quaid-i-Azam University, and the recent prize winner in Mathematics, Dr. Naseer Shahzad, who shows immense promise. There have been many other Salam Prize winners who have also demonstrated their worth since receiving the prize. In fact, the prize acquired an international reputation and has been emulated outside Pakistan. I remember Professor Salam telling me about it one day with great pleasure. His appreciation of my efforts displayed at the time will always be one of my most cherished memories.

Professor Gordon Feldman mentioned that some time before he received the Nobel Prize Salam had been referred to as "the next Einstein".

This was not an exaggeration. A scientist does not enter that special category to which Einstein belonged just on account of his contributions to his special field, but because he has had a greater impact — he has become a household word for people outside his own field. Of course, he must have made a major impact in his own field. No one can doubt that in Salam's case. We have been hearing of the many contributions he has made to high energy physics. They started with his work on renormalization. Then he missed getting the Nobel Prize for his idea of parity non-conservation. He went on to the pioneering work on SU(3) for which he could easily have got the Nobel Prize. Though his early attempt at unification of internal and external symmetries (SU(6,6)) was not successful, it led to the idea of supersymmetry, which is one of the main driving ideas of modern high energy physics. After Wess and Zumino presented their paper on supersymmetry, he and Strathdee wrote it in more easily usable terms. Many workers continue to use the formalism set up by Salam and Strathdee. His work on electroweak unification needs no comments. However, it is worth pointing out that the first published idea of Grand Unification is in the paper of Pati and Salam in 1972, as is the original suggestion of proton decay. Regardless of the outcome of the suggestions, it cannot be denied that these ideas have guided the development of high energy physics in recent times. In fact, I remember a talk by him on the morning of the 29th of January 1971, just before my PhD *viva voce* examination in the afternoon, in which he mentioned the hope of unifying the strong with the weak and electromagnetic forces and finally incorporating gravity. Though he was thinking of SU(3) flavour instead of colour, the basic idea was already there at that time, and has driven developments in fundamental physics ever since. All this, however, would not have made his name a household word. The impact of Einstein was felt through the philosophical implications of his work, and was later felt at Hiroshima and Nagasaki. That is not the impact of the Servant of Peace. Due to him, any number of scientists have been able to continue to work in the Third World and to maintain their contact with the latest developments in science. This has enabled those countries to bring up a new generation of much better educated scientists, who can maintain a hope of trying to catch up with the rest of the world. It is in this sense that he was the next Einstein.

We, of the Third World, must re-dedicate ourselves to carry on the mission of Salam, to return to our home countries and with a fresh commitment pursue the dream of development through the development of science. We, of Pakistan, have lagged far behind in our attempts. We did not give enough recognition to Salam — but worse, we let him down in his mission. Now we need to work all the harder to bring a more measurable success to his attempts for the betterment of his home country.

ASGHAR QADIR is Professor of Mathematics at Quaid-i-Azam University, Islamabad and a Senior Associate of the Abdus Salam ICTP. He was a student at Imperial College in the late sixties and was advised by Abdus Salam regarding his undergraduate and postgraduate studies. Salam encouraged him to work for the development of science and mathematics, in Pakistan in particular. He was closely associated with his mentor in running the Abdus Salam Prize in Science in Pakistan.

OUR GRANDFATHER

Imran Saadi

I would like to begin by saying how privileged and honoured I and my whole family feel today on this very special occasion. Many of you have spoken about my grandfather's unique and great scientific achievements. But I would like to say a few words about the more personal aspect of his nature, especially with us grandchildren. During my childhood days, to me Professor Salam was only a grandfather. As the years went by and I got older and more sensible, I did realise that he was more than just what I had imagined about him. This I came to realise when I first visited Trieste, and saw the magnitude of his work.

Because of his very heavy time schedule, most of my conversations with him took place in the car, when I used to accompany my father to receive my grandfather at the airport. Needless to say, the conversation was always about education, especially mathematics and physics. This reminds me of the following episode. I must have been 8 or 9 years old, and I was sitting in the car, in the back with my grandfather, and he wanted to test me on my maths. He asked me: "What is a plus b squared?" To this my father, who was driving the car, tried to come to my rescue by saying that I had not got to that level yet. My grandfather did not appreciate his interference, and looked towards me for an answer. I said to him: "I am sorry, but I do not know the answer." I must admit that he explained the question in such a simple way that I did actually understand what he was talking about. Just when I thought that I was out of the situation, he said to me: "Imran, now tell me, what is a plus b whole cubed?" This made me think that probably when he was 7 or 8 years old, somebody must have put him in the same dilemma. I wonder.

Apart from education, let me take you to the more personal and loving side of him. One thing all of us kids had in common with him was his love for chocolates, and we knew that he would always carry a stock in his bag.

We would all gather around in expectation of him opening his bag and sharing his delights with us. However, there were times when we had to share our stock with him.

My grandfather had a very soft spot for his three granddaughters. When he was unwell and found speaking difficult, they devised a special sign language amongst themselves. My grandfather, as you know, had a sweet tooth, and the three girls always received a special signal when he needed a little confectionery.

These experiences are very brief, but are special to the people who remember them. It is now, as I am older, that I appreciate his immense contribution to the world of science and humanity. It is the humanitarian side of him that I remember most. His humility is something that has been passed on to all of us. He told us that if something is not essential, learn to go without it and make full use of what you have. This came from his own background, which he never forgot. His own roots were very humble and he carried this throughout his own life. He also taught us that time is of the essence, and never to waste a single moment. He himself spent every minute of his full life working to better all the people of the world, especially the students of the Third World. Coming to the present generation, we are all very grateful for being given this opportunity to be here today. My grandfather has left a huge legacy to us all, and one of which we are extremely proud. We are privileged to have known him and shared his life, even it if was only for a short time.

TRIESTE AND MY FATHER

Umar Salam

I am very glad to have this opportunity to say a few words, I feel it is a great privilege. On behalf of all my family, both here and in Pakistan, I would like to express our deepest gratitude for honouring my father: not only with this meeting but also with the permanent memorial that is to be the Centre's new name.

In particular I would like to thank Professors Virasoro, Faheem Hussain, George Thompson, John Ellis and Tom Kibble; also Anne Gatti and all the staff at ICTP, and everyone else who has taken so much time and trouble over the organisation of this unique event. It has been particularly pleasurable the way in which this occasion has paid tribute to both the professional achievements and personal qualities of my father, and I would like to thank all the speakers for the wonderful talks we have heard over the last few days and for those we shall hear tomorrow.

Over the course of these talks, my father has been referred to as a "mentor", "a man of power", "a successor to Einstein". However, even he had moments of doubt and anxiety. In 1964 whilst ICTP was moving into its buildings in the Piazza Oberdan, he wrote:

"One cannot even smile. It is cold, raining, miserable. The morning was occupied in trying to get shelves and mats, trying to get the place clean and free of cigarette ends [...]. We discovered that there are only three power points per floor, and there will be no heating until the 15th November at the earliest. In the afternoon, I at least, just could not stay. I marvel at the uncomplainingness of the others. God forgive me for accepting this place."

Fortunately it was to get much better. Later on he was to remark:

"Trieste always calls me to spirituality. I pray, I listen to the Holy Book, the real feel of love, of gratitude, and thankfulness for all of Allah's bounty."

I remember him describing the 25th anniversary celebrations of ICTP in 1989 as the happiest day of his life.

Ladies and Gentlemen, it was through his faith in his goals, his religion, and the people he had around him that he was able to turn his ideals into realities. It is very good to see those realities being continued today.

MY FATHER

Ahmad Salam

Ever since I received a fax from Dr. Hamende asking if I would care to write a few lines for the forthcoming book of reminiscences of my father, I have struggled to clearly form in my mind what I want to say. I know what I could include, there is so much I could say; I could literally write pages and pages. However instead I have decided to just write a few memories which I hope will give the reader a little more insight into just how remarkable my father was, and also into the private side of him. If this piece seems disjointed, then I apologise and ask the reader to please bear with me.

I am extremely blessed, by the Grace of Allah, to have two most wonderful boys and I have experienced the rewards of being a father; to see them grow and learn and to spend time with them, to guide and inspire them. My father made perhaps one of the biggest sacrifices to achieve the aims and ideals he deeply believed in: his time to be with his own children. I know how he regretted this because we spoke about it later, just once, but it was enough for me to understand the loneliness and sadness he went through in order to pursue his bigger goal. He knew he had to give his time to other more needy "children". In his mind that was a matter of necessity; whereas we could have him as much as we wanted, and our mother was always there for us, these other children needed his support, guidance and affection. Father had learnt first hand of the benefits of an ever present and caring father from his own father and so knew the great blessings that a father's presence could bestow. I suppose he also knew the most he could ever really do for all his children was to pray to Allah to guard and guide them and that he did in abundance.

I have heard the story about Father who, when asked how many children he had, would reply that he had "a few thousand"; that was the number of "children" that had passed through the ICTP. These were his surrogate "children" and when I meet some of them now, and I see how much he did for them, how much support and inspiration he gave them in addition to help in so many other ways, I realise how essential it was that he gave so much of himself to them.

All this, however, does not change the fact that it was always difficult for either of us to fit in being a father and son in the space of a few short hours on a fleeting trip to London. Hence, especially in the early years, the trips with him and the ability to spend time with him were so important. I remember clearly, at the age of 6 or so, moving my bedding into his room just so that I could be with him on one night when he was in London. I now realise that when he would ask me to come and drop him at Imperial College, or come to the airport to see him off, this was his way of trying to find time to be with me. These car journeys became extremely important for him to catch up and give me a few ideas and some guidance, and though I did not realise it, it taught me some very valuable lessons. More often that not, it would be for him an opportunity to give me an explanation on how something worked, such as a car engine, or the human heart, or how to solve simultaneous equations, or to give me some story of a famous Rajput warrior or prince. These were extremely important moments for both of us. We enjoyed quality time together, uninterrupted by others.

Similarly whenever he was in London, he would always insist that we, as a family, had at least one dinner with him, where he would go round the table and ask what we were studying at school, how we were doing and whether we had any problems he could help us with, etc. As I was the youngest my turn would come last, hence my turn would often take place in his room after dinner. He would invariably be in bed by then, his room would always be dark, lit only by a single table lamp, with the aroma of that day's incense sticks still clearly in the air; the room would be very warm. I will always recall how he would come to the essence of any problem and would always manage to reduce it to its most basic form very quickly. Father was always tremendously supportive and always offered any assistance he could, in any way that he could.

So how did Father know that by just spending a little time with us he could extract the maximum benefit from this time? He knew that while he focused on his work, we were in the best possible hands of someone who would not only take care of our physical necessities, but also our moral and spiritual needs; he could leave it to someone uniquely qualified and able to do a first class job of bringing the four of us up: our mother. I know the truth in the saying that "behind every great man is a great woman". Thus we, my father, my sisters and I owe my mother a huge debt. My father always recognised that without her incredible ability to raise four children, run the house, which in itself was no mean feat in those days, take care of all the tasks and problems a man would normally do, all in addition to pursuing her own career as National President of the Ahmadi Muslim Ladies Association, he could never have had the time to pursue his goals and make them realities. She gave him the freedom and support he needed, and was able to take away much of the drudgery. I must pay tribute to my mother, as much as gratitude from myself and my sisters as from Father; she was able to recognise clearly what kind of support he needed the most and selflessly stepped into a very difficult role and performed it, and still performs it, with great accomplishment.

Father instilled a few lessons in me and I would wish my children to have the same lessons. Firstly the single and total belief in yourself and whatever you are trying to achieve, and the fact that if you believe something is right, and I mean really right, then have the courage of your convictions. I remember one time when he said to me "to hell with what other people think, it is what you think that matters and if you believe in it enough, you should just do it". To an impressionable fourteen year old, this was very stimulating.

Father was hugely influenced by his parents: the discipline and moral tone of his father and the total love of his mother. He was greatly influenced by his father who was a very strong character and a great disciplinarian when required. My father had a total and utter devotion to both his parents and taught me and my sisters the same dedication to our parents. He showed us all the fact that we are nothing without the prayers of our parents, and that they are the best friends we could ever have. He showed us that they were the first priority and their welfare was paramount. This again was one of those timeless lessons we all need to be reminded of.

Father showed me and always made me aware of good manners and politeness. He showed me how to be a most generous and welcoming host to everyone without exception. I remember whenever he was travelling on official business, if he had a car and driver come to take him anywhere, or drop him, the driver was always invited in to share a meal or have a drink, instead of just waiting in the car. Every single person was treated with the same degree of affection and respect, irrespective of who they were or whatever their background.

Father made me hugely aware of the importance of Islam: the total belief in Ahmadiyyat and all it stood for and our cultural Rajput heritage. He would tell me of my lineage from a fighting warrior class and how I must uphold those noble traditions of honesty, integrity, strength and intelligence. Father was also a great historian, not just of the Islamic world, but of all history. This was his form or relaxation. Biographies were of great interest to him, be they of Napoleon, Churchill, Gandhi or Charlemagne for example. These people provided great leadership qualities, strength and foresight and planning and hence he would spend time learning from their experiences. The cultivation of great people and the jealous guarding of time against waste were crucial qualities. Father would always make me sit with him if he was meeting with somebody important. He wanted me to be exposed to great and inspiring company and always encouraged me to choose my friends carefully.

Father would visit the Mosque whenever he was in London, and would offer his prayers, but once prayers were finished he would leave the Mosque; if anyone wished to meet him he would willingly stop and meet that person, give some advice or offer some words of encouragement, but then he would leave as quickly as possible. He could never abide anyone who simply sat around and wasted time in idle chatter. For him, this and backbiting were the most abhorrent features a person could have.

Time was never to be wasted; never. One should use every moment in mental stimulation and exercise. Even the bathroom was a place of contemplation. Indeed visitors were often amazed at the library in our bathrooms, in London, Oxford and Trieste, with books and magazines ranging from Huxley, Waugh to Wodehouse and Shaw to *New Scientist*, *Physics Today* and *The Economist.* Time was the most important blessing, bar none. There was never really any concept of holidays. I cannot recall Father ever taking a holiday or having any time off. My holidays were a stream of carefully planned days with tutors and work. I was tested on a daily basis on what I had learnt when we sat down for dinner that evening. These moments were pretty terrifying as I realised I could always have done more, read more and understood more. I think Father also expected more of me. He had learnt to do this from his father and he wished to ensure I did the same. In the same vein television was deemed to be a waste of time, though I remember Father would only ever watch two programmes, one was *Dad's Army*, a timeless classic English comedy, which literally make him slide off his chair with laughter, and the other was also a comedy duo called

Morecambe and Wise. Both these programmes were simple and innocent fun; much missed in programmes today.

Father also believed very carefully in the adage of "Early to bed, early to rise". He himself would retire at 8 pm or so, with lights out by 9 pm and no exceptions. There were no phone calls after this time, and if the phone were to ring he would not be best pleased! Friends and family knew not to phone when Father was in London. Equally no one was to phone when we were having dinner. People who did so were asked to call back. This was a golden rule. Father would sleep very well indeed; I was often amazed at his ability to close his eyes and sleep, wherever he may be without exceptions, in a car, on a plane or wherever he had a few minutes to close his eyes. He also had a great ability to work anywhere, to write notes or jot ideas on whatever may be to hand, a newspaper, a napkin or whatever. He once wrote something on a napkin whilst lunching with the Queen at Buckingham Palace and after the lunch, when Her Majesty had left the room, he returned to ask if he could have the napkin! Wherever he was, Father would rise early. At home he would rise at 3.30 to 4 am and say his prayers, followed by a few hours of uninterrupted work, accompanied and fuelled by pre-placed tea in a thermos flask, cashew nuts, digestive biscuits with cheddar or Danish blue cheese, or Ritz crackers and fruit such as bananas or apricots. These items were placed on a tray with a jug of water the night before. This was the daily routine whilst both in London and Trieste. He would then start work at 4 am and carry on until 7 am or so when he would get us up and have a full breakfast, a shower and get dressed. I will always remember Father's heavy footsteps on the stairs coming up to make sure we were out of bed at about 7 o'clock. We would literally jump out of bed and pretend we had been up for some time! Breakfast in the earlier days would be sausages with egg, or smoked haddock. Later he progressed to fish fingers, then to muesli and then he came back to fish fingers later in life. Many of his snacks were temporary phases, depending on what he was into at the time. His classic favourites were sweet mango pickle, camp coffee, muesli, digestive biscuits and of course chocolates and Pakistani sweets. Father had a very sweet tooth and justified this by saying it gave him energy to work. He would travel with large amounts of sweets, biscuits and nuts in his bags which he nibbled at all day long. Indeed if the bag were empty, we would have to restock either en route to the airport, or after check-in if necessary.

Father hated shopping (another waste of time!) but loved a bargain and would often pick up armfuls of something because it was cheap. Once in New York he found some $7 shirts and proceeded to buy fifteen! He had a tremendous appetite for news from Pakistan and listened to Radio Pakistan on a daily basis. In the early days he would buy very cheap and not very effective Russian radios. He soon realised it was not worth buying the inferior product as he wasted so much time trying to tune the radio to get a good signal, so then he ended up buying some high quality radios. Later on he invested in a stereo system to listen to his Quran records and then moved on to some very good quality cassette players. His favourite recordings were by an Egyptian called Abdul Basit, who had a particularly melodic tone to his voice. These tapes were a huge source of inspiration to him until the very end.

Father was not a clothes man; he initially bought the bare essentials and at the cheapest prices. But later in life he began to buy high quality suits from Gieves and Hawkes of Savile Row, because they lasted much longer and hence he did not have to waste time shopping. Incidentally I only recently found out the reason as to why he had such a soft spot for Gieves. You will have to read my uncle's forthcoming biography to find out this reason. I must point out that he only visited this shop when the Annual Sale was in full swing so he could enjoy a bargain. Appearance was very important to Father and he took great pride later on ensuring he was well turned out.

Father taught me the importance of education at all levels; the importance of books and the importance of their care. If I ever expressed any interest in a book, he immediately would buy this for me. There was never any limit to the number of books I could have, provided that I treated them with extreme care and respect. We spent many hours wandering around book stores together. When he was at Imperial College he had two favourites; one was Karnac on the Gloucester Road and the other was Oppenheimer's in South Kensington. He admired Foyles, but found it too disorganised in its layout. With ever an eye on a bargain he favoured second-hand book shops. There was, and indeed there still is, a small second-hand and new book shop on Richmond Hill he enjoyed visiting. I think both Umar and myself spent a considerable amount of time there. As visitors to our house in Putney will verify, books were the greatest asset he felt he could give us, and through them the love of knowledge. This tremendous and voracious appetite to learn never abated and perhaps it was one of his most enduring qualities. I was amazed to find in his library books as diverse as *Teach Yourself Russian*, *Teach Yourself Air Navigation* and *Teach Yourself Ballroom Dancing*. I think the latter was a mistake! We also have any number of English/Italian dictionaries which were never used.

In the early days Father was a great fan of opera, especially Gilbert and Sullivan. Classical music was also interesting, especially Mozart and the waltzes. Indeed near the end of his life, opera provided a great deal of happiness and stimulation for him in addition to his prized collection of Quran tapes. Father also had a real appreciation of the finer things in life; literature, art, food and music. In addition to his legendary knowledge, he enjoyed his spare time. I remember his total love of all things Islamic; at the age of 10 or so I remember him being thrilled at being invited to see the Whirling Dervishes who were appearing in London. I of course did not realise the significance of this sight, but Father was absolutely enchanted and loved the evening. He loved Islamic art and poetry, in addition to architecture and as I mentioned earlier, he adored listening to his Quran tapes. One of his greatest pleasures was to give and receive different recordings of these Quranic recitations. To have the Quran playing in the background while he was working was the greatest stimulation to him.

I really could carry on for many pages, but I feel I should wrap up this piece with a mention of one particular quality I will always recall with the greatest admiration. During the last years of his life, when the illness was getting worse and becoming more and more crippling, right to the very end, he never ever cursed his misfortune or complained. He suffered very quietly; having been a man of great independence to suddenly become totally dependent on people, and to have to need people for doing the everyday things we all take for granted, must have been very hard for him. He only ever allowed a very few people to see him at his most vulnerable. He accepted that the illness was entirely Allah's will and therefore it was to be accepted with complete serenity. He was never angry or bitter about his illness. He had tremendous courage and strength. Even when he was in such obvious discomfort and pain, he never once voiced his anger or frustration.

This is a very poignant memory to close on but I think it is apt because it shows the total and utter belief in the one force which drove him and motivated him above all others and which he completely accepted: the will of Allah the Almighty.

Mirza Tahir Ahmad
Head of the World-wide Ahmadiyya Muslim Community
United Kingdom

In the name of Allah, Most Gracious Ever Merciful,

I take this opportunity to express my gratitude to the administrators of the International Centre for Theoretical Physics, to the convenors of this conference and to all the delegates who took time to come for paying tribute to the cherished memory of the late Professor Dr. Abdus Salam.

I express my gratitude once again to the organising body for providing me with the singular satisfaction of being associated with this auspicious occasion in the honour of a unique man of genius.

I knew him from my childhood but only in a way that a child would know of stars. There was nothing intimate and personal in our relationship which began in earnest as late as 1978 during my holiday visit to North America and Europe. When he learnt of my arrival in London with my wife and two elder daughters, he insisted that I find time to visit his home. Perhaps he also had in his mind the intimacy and love with which my late mother always treated his wife when she was a young student at Qadian prior to the partition of India and Pakistan. His wife, Amatul Hafeez Begum, was even more keen for me and my family to spend a few leisurely hours at their home with their family. While the ladies were busy chatting together in another room, Dr. Salam and I were closeted together in his personal room. It was then for the first time that we developed a deep personal, intellectual, spiritual and cordial relationship which was to last till his death. His death left me mourning the departure of a most charming person whose interest was not confined to any single field of human inquiry.

During that meeting, I discovered him in the broadest perspective in which he deserved to be discovered. He knew religion, he understood the philosophy of cryptic Su'fism, his knowledge of history was wide and profound. Theoretical Physics was his subject but that was not the only subject of which he had a masterly command. His profound knowledge of chemistry, biology and the universe of sub-particles was amazing. His intimacy with cosmology was no less surprising. But when it came to the vastness of nature and its oneness with the attributes of God it was there that he out-shone all other fields of his intellectual pursuits. His theory of the unified field must have sprung from his total dedication to the Unity of God. He had a firm belief that everything began with Allah and will end up in Him. This might have motivated him to scientifically prove the hypothesis of the unification of the fundamental forces of nature. During our discussions he revealed to me that he had already advanced his research to demonstrate the Unity of two other fundamental forces. Had his life permitted, I am sure he could have received another Nobel Prize for his advanced work in this field.

This short tribute to the memory of his genius is not meant to dwell upon all his scientific achievements. I want to share with this august assembly today only a few glimpses of Dr. Abdus Salam, a man who did not hesitate to discuss immense complexities of his advanced scientific knowledge with an uninitiated person like I was. He took pains to make me understand why the speed of light could not exceed 186,000 miles per second. I continued, however, to argue that under certain hypothetical conditions, the speed of light could be enhanced beyond this limitation. His tolerance with me during the course of this discussion, while I was a mere novice on the subject of theoretical physics, was a great tribute to his patience and grand-heartedness. At the end, however, he cautiously conceded that if, as I suggested, the properties of the medium which facilitates maximum speed of light could be visualised to be different, the speed of light would correspondingly change, even transcending the present limitation. It was not his personal conviction, of course; his acceptance was conditional only to the big "if" involved. He accepted my suggestion, realising perhaps that the real implication of my suggestion was related to the limitless attributes of God.

Among many questions I raised to quench my thirst for knowledge was one regarding the incomprehensible nature of heat radiation. It could travel at the speed of light, as though riding its wings, yet it could also move so slowly as to take ages to reach the other end of a large room. If a fire is lit in one corner of a big hall, the people sitting in the other corner would hardly feel any heat emitted by the fire.

This and many other intriguing questions were raised by me and answered by him in full earnest. To the question of heat radiation, he answered, as though in a confidential tone, that the one thing which even the scientists fail to understand is the true nature of heat. It was during that fascinating informal talk that I came to learn of the vastness of Dr. Abdus Salam. It was in that unique vastness that his genius lay. Ever since that meeting we were not really separated again. He continue to seek my interview to help him resolve various problems which confronted him from time to time and I never failed to make the best use of such meetings to enhance my personal knowledge.

His philanthropist attitude was boundless. It was truly universal without the least parochialism. No religious, political, ethnic or nationalistic boundaries were charted on his purely human heart. The International Centre for Theoretical Physics in Trieste has always paid and will always pay a standing ovation to the humanist in Dr. Abdus Salam.

Allah bless his soul in the hereafter and may He also bless the noble objectives he pursued in the vastness of the material world he has left behind.

AFTER-DINNER SPEECH

Gordon Fraser

GETTING PAULI TO APOLOGISE

Gordon Fraser
Editor, CERN Courier
Geneva, Switzerland

On learning that I was to give an after-dinner speech to an audience composed predominantly of such distinguished theorists, I felt like a Christian in ancient Rome who had been selected to be thrown to the lions. To learn how to handle lions, I looked in the Bible, to see what the master lion-handler, Daniel, did.

"And the King commanded and they brought Daniel and cast him into the den of lions. And a stone was brought and laid upon the mouth of the den, and the King sealed it. And Daniel was alone among the lions. But he was not afraid and looked upon the lions, right in the eye, and said unto them: 'Which among you is going to give the after-dinner speech?' And the lions were much afraid and spoke unto each other and each said 'Not me.' And the next morning when the stone was removed from the mouth of the den, Daniel walked out unharmed and the King was much impressed."

Leon Lederman is good at giving after-dinner speeches. He is not here, maybe because he is not a theorist, otherwise he would have given this speech. One particularly memorable Lederman after-dinner speech was at the Munich Rochester Conference in 1988, which was held in a brewery — the dinner that is, not the conference. Everybody fell about while he gave his speech. Afterwards I asked him how he did it. "It was the easiest speech I have ever made," he said. "Everyone had already drunk at least four litres of good German beer." As Salam was a practising Muslim, I will not ask you to raise your glasses at the end of this speech. But if you haven't drunk enough good wine already, please do so now.

Salam himself gave after-dinner speeches. At a 1985 physics history meeting at Fermilab, Salam gave one entitled "Physics and the excellence of the life it brings", a title which he acknowledged to have stolen from J. Robert Oppenheimer, but by then Oppenheimer was not in a position to object. "Physics and the excellence of the life it brings" — such wisdom is indeed true, provided one can excel in physics, or any other subject for that matter, to the extent that Salam did.

Despite the fact that tomorrow the Centre will be renamed in his honour, tonight I come to say good-bye to Salam, not only to praise him. To do this I first had to try and find an anecdote which showed some chink in his formidable intellect. I asked a former research associate, now a world-famous theorist, let us call him theorist A, who knew Salam well, if he could supply me with a suitable anecdote. Nothing was forthcoming, so I went to another world famous theorist, let us call him theorist B. I told theorist B I had already talked to theorist A. "Theorist A is not a great theorist," replied theorist B sternly. "It's just that he has a photographic memory." Undeterred, I went to a third theorist who told me of a joke which Salam himself had invented. Unfortunately I could not understand it.

Then I remembered that experimental physics was Salam's Achilles' heel, recalling his words describing his first encounter with experimental physics research at Cambridge in 1949 — "It was the sublime quality of patience that I lacked. Patience in accumulating data, patience in handling recalcitrant apparatus. The craft of experimental physics was beyond me." So I went to an experimentalist, who told me about an idea Salam once had that CP violation would switch off in a very high magnetic field. So Salam went along the corridor to see the Imperial College experimentalists and explained his idea. "What field do you want?" they asked; "1,000 tesla," came the reply. The experimentalists chortled. "Sorry, but we could give you 20." Salam looked at his calculations. "Perhaps with 50 we could see a flicker of an effect," he said. The experimentalists began to look at grand schemes with huge capacitor banks discharging into solenoids to give brief pulses of 25 tesla. Several weeks later they were having a meeting to discuss progress, when there was a knock at the door. It was Salam. "Well, what's the result?" he asked.

So it came to pass that in January 1966 we were chained to our desks in the theoretical physics department at London's Imperial College, duly paying intellectual penance by calculating SU(6) Clebsch-Gordan (CG) coefficients, taking the traces of huge matrices, and the like. It was stultifying work, not at all like the glamour I had expected, no pearl-like equations fell from our blunt pencils to enlighten the world. One by one the insipid fruits of our labours emerged, but, like unpeeled potatoes, the pile of CG coefficients or traces left to calculate did not seem to get any smaller.

Suddenly there was a loud noise outside in the corridor, and the characteristic chortling laugh of Salam. "You can all go home," he called out. "We've solved it all." I looked up from my desk and a new future in experimental cosmic ray physics beckoned. But I remembered how I had been caught out all those years ago and remained stubbornly at my desk.

What Salam had developed was his U,~ (12) symmetry picture which combined Gell-Mann and Ne'eman's SU(3) with something resembling the Lorentz group, in an attempt to get a covariant framework for strong interactions. Colour SU(3) was only on the far horizon, and there were only three quarks. Nevertheless, in his published paper, Salam claimed: "With the vertices available, it is but a trivial step to write down pole approximations in a Mandelstam representation." With U,~ (12), there was a flurry of activity as people began to grind out fresh calculations, but stopped short of this "trivial step". Salam soon realised that he had been the victim of his own exuberance, and fortunately returned to his old love, the search for electroweak unification, still up his other sleeve.

Like most of us, Achilles had two heels. Another Salam characteristic was his insistence on selling his ideas at the highest possible level. The crowning example is the episode in 1956, when after hearing Lee and Yang suggest that parity was violated in weak interactions, Salam thought of the two component massless neutrino theory during a transatlantic flight. "During the flight," related Salam afterwards, "there came to me a deeply perceptive question that Peierls had asked me in my PhD *viva voce* several years before — 'Why is the neutrino massless?' During that night in the air, the answer came. The neutrino is massless because it is left-handed, a miniature corkscrew drilling its way through space-time at the speed of light. As it cannot be overtaken, it always looks left-handed, and parity is violated in weak interactions." Arriving back in England, Salam hurried to Birmingham to tell Peierls that he finally had the answer to the trick question posed several years before. One can imagine Peierls' surprise at finding an agitated Salam unannounced on his doorstep. "Peierls' reply was typically polite but firm," related Salam. Peierls' recorded reply is "I do not think that parity is violated in weak interactions at all." Which is a very nice physics euphemism for "Who do you think you are? Get the hell out of here!" But Salam would not give up, and gave his neutrino paper to a physicist who was going to visit Pauli in Zurich. This was a rash thing to do, because Peierls had worked together with Pauli on nascent neutrino ideas in the 1930's. Peierls and Bethe had first calculated the staggeringly low neutrino cross-section which led Pauli to wager that neutrinos would never be seen.

Pauli had lost that bet and therefore was reluctant to bet on neutrinos again. Nevertheless Pauli was convinced that parity was good and was not impressed by Salam's ideas — "Tell my friend Salam to think of something better" were his words. Dispirited, Salam hesitated before submitting his massless neutrino for publication. Four months later, Mrs. Wu's result on left-right asymmetry in beta decay had been published, Pauli had changed his mind and Salam's ideas had been vindicated.

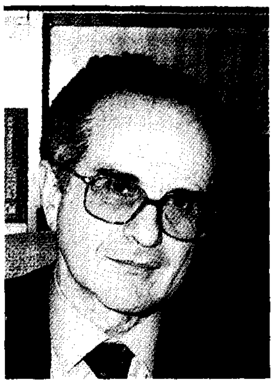
Had Salam ignored Peierls and Pauli and published his ideas immediately, it would have been a triumph. As it was, Pauli apologised to Salam at a special meeting at Harwell in December 1956 and again in a letter dated 24 January 1957. Fewer physicists have garnered an apology from the formidable Pauli than have won Nobel prizes. There would be no looking back. Ladies and gentlemen, we are privileged to have known Abdus Salam.

Thank you for the invitation to be here and I wish the renamed Abdus Salam International Centre for Theoretical Physics Godspeed in its continued mission.

GORDON FRASER obtained his PhD in theoretical physics at Imperial College, London, in the group led by Paul Matthews and Abdus Salam. He subsequently moved to science journalism, becoming Editor of *CERN Courier* magazine. He is also co-author of *The Search for Infinity* (Reed Books, London, translated in nine languages), author of *The Quark Machines* (1997), and Editor of *The Particle Century* (1998), both from Institute of Physics Publishing. He is a visiting lecturer in science communication at several UK universities and is currently writing a popular book *Antimatter*.

MESSAGES

Maurizio Iaccarino
Igor Saavedra
Victor Latorre
Sergio Mascarenhas



A MAN OF VISION

Maurizio Iaccarino
Assistant Director-General
for Natural Sciences
United Nations Educational, Scientific
and Cultural Organization

I much regret that I cannot be with you to honour the memory of Professor Abdus Salam and to join you, his friends and colleagues, in expressing in person my respect for this great scientist and man of vision.

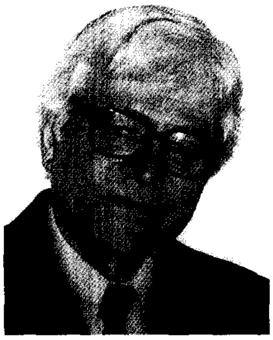
Professor Salam was a man of truly exceptional scientific and human achievement. He was a brilliant scientist who was honoured world-wide for his outstanding contributions to advances in physics and who received — among many other awards and distinctions — the Nobel Prize for Physics in 1979.

Within the United Nations system, Professor Salam was no doubt best known as the founder, first Director and President of the International Centre for Theoretical Physics (ICTP), a centre that functions under the joint auspices of UNESCO and the IAEA, with the generous financial support of Italy. ICTP embodies his vision, energy, scientific eminence and leadership and his devotion to the development of the Third World. Professor Salam was also widely know as the founder and first President of the Third World Academy of Sciences (TWAS) and the Third World Network of Scientific Organizations (TWNSO).

ICTP and TWAS were particularly close to Professor Salam's heart. They constitute the unique heritage to the world and are living monuments to his ideals and his vision for the development of science in the Third World. Let us work together to ensure that these institutions live on and flourish.

MAURIZIO IACCARINO has been the Assistant Director-General for Natural Sciences at UNESCO since May 1996. He graduated in Medicine and Surgery from the University of Rome in 1962. He joined the International Institute of Genetics and Biophysics of the Italian National Research Council (CNR) in 1962 and was the director of that institute from 1985 to 1993. From 1994 to 1995, he directed the Institute of Molecular Genetics of the CNR at

Sassari. Iaccarino is an Associate Fellow of the Third World Academy of Sciences and a member of several learned societies. In addition to his considerable research activity he has been involved in numerous scientific committees at the national and international level.



REMAINING PART OF THE WORLD OF REAL PHYSICS

Igor Saavedra
Department of Physics
University of Chile

As we all know, Professor Salam was certainly more than just a distinguished, Nobel-class physicist. He was also a passionate standard-bearer of Third World science and scientists, ICTP being a paradigm of this. Personally, I feel much indebted and grateful to him. Without his unfailing support it would have been impossible to start and help developing a theoretical physics establishment of international status in Chile.

My professional relation with him extended for a number of years, having started when he was the external examiner for my PhD thesis and, after the exam, he invited me to carry on my research work at his Theoretical Physics Department, Imperial College, London, with a post-doctoral grant I had been awarded.

Later on, when my three-year grant was going to expire and I was completing five successive years in England (the first two as a student), I decided that I should return to Chile to start a research activity in theoretical physics in my country. Professor Salam reacted indignantly to this. In harsh words he told me that the proper way to be successful in that endeavour was exactly the opposite one, as he himself had previously done: to stay in the UK and get as high up as one could in the international physics establishment. Only then one would be able to effectively help young physics students in a developing country, as he was doing.

We sharply disagreed, as I thought that it was my moral duty to return to help young physicists-to-be become professional researchers in theoretical physics, because at that time (being Chilean) I was the only one who could do it.

I therefore went back to the truly "scientific wilderness" my country then was, and after less than two years I found myself (as a physicist) as a squashed lemon: I had nothing to teach concerning recent research results, I could only teach already-stale physics. I thought it was dishonest to carry on that way and that I should give up and return to Europe.

Then Professor Salam came to my rescue. He had succeeded in founding the ICTP and invited me to join him there. That was the beginning of my relationship with Trieste (and with Miramare later on) which was to last for many years, and my re-encounter with the stimulating air of the neighbourhood of the frontiers of research. I started to return to ICTP every winter (the summer vacations for Chilean students) for three or four months each year, successively as a Visiting Scientist, an Associate and a Senior Associate of the Centre, all of them being schemes Professor Salam invented as years passed by to help people like me to remain in the Third World and still be (or rather, feel) part of the world of real physics.

Today there are over 100 active theoretical physicists in Chile and, as far as my own contribution to this effort is concerned, I can only say now, in spite of all our disagreements on questions of principle: Many thanks again, Professor Salam.

IGOR SAAVEDRA is Professor of Physics at the Faculty of Physical and Mathematical Sciences at the University of Chile. He is a member of several academies of science. He has been President of the Chilean National Research Fund, Chairman of the Chilean Atomic Energy Commission and Vice-President of the Chilean Academy of Science.

ABDUS SALAM IN PERU

Victor Latorre
Multiciencias, Lima, Peru

When I asked Abdus Salam what he had enjoyed most in Peru, he told me that it was the children in Pisaac (a small town in the Sacred Valley of the Incas, near Cusco), chanting *premio nobel, premio nobel* (Nobel Prize) after him. That meant that knowledge was likely to be appreciated anywhere in the world.

He had arrived in Lima in February 1980, fresh from Stockholm and having awakened the interest of the Peruvian military government, which had been alerted by its diplomatic mission in Brazil. We, physicists in Lima, had been asked by our diplomats about his visit and his intentions. The military were actually on the way out, after eleven years in power. Elections had already been called, the same elections where Sendero Luminoso would make its ominous debut.

Abdus was always a practical man, so unexpected to the educated man who pictured a theoretical physicist as an absent-minded dreamer. On moving from the airport to the city he said to me: "Let us get together with a group of local active scientists and engineers, someplace quiet, and discuss one simple thing: what Peruvian physicists could best do to help raise the GNP of the country."

That same afternoon I took him to the house of don Mario Samame, our old revered Rector, who had already started to round up friends for our meeting. Our Foreign Office had continued to speculate on whether Salam would ask to see the President or not. Salam had already decided not to visit the President, but to informally call on the Foreign Minister, the only civilian in the cabinet. He was to slightly alter his decision in a way, as we will see shortly.

We started talking or rather listening to Salam, who loved loud and boisterous talking, but in time everyone contributed his ideas. Then all of a sudden I noticed he was gone and so I went to see what the matter was. The host, don Mario to us, did not speak English and I wondered what Abdus needed at the moment. I found them together in an empty room with the problem already solved. Don Mario had found a small carpet for Abdus to kneel on and say his prayers. The proper local time and the right direction to face had already been well determined.

We talked for two days with people coming and leaving all the time. Don Mario had been a presidential candidate in 1962 and had many friends. He was an authority on mining. The variety of Peruvian minerals is tremendous, but separation, identification and purification for proper pricing and exporting was hardly well done. Here was a field where physicists could help, using the spectroscopic tools of modern physics. I also learned then that the most scientific miners in the world were the Australians. They perforated rock with electron accelerators. The Europeans and the Americans of course had better science, but they did not have large mines to exploit like the Australians.

Abdus had seen the Foreign Minister and don Mario was now urging that we go to see the Mining Minister, an army general of course. A Centre for the Study of Minerals would allow the physicists to make their practical contribution.

Abdus had been to the offices of the Atomic Energy Commission and had discovered that the man in charge was also a general. He had been surprised to learn that a 10 MW experimental reactor was under construction in Argentina for the Commission and had immediately asked the general what they wanted such a reactor for. It had the wrong energy: too high for conventional applications and too low for what "you have in mind".

So, Abdus was hesitant to see another general. But don Mario prevailed and we took him to the Mining Ministry. The Minister, forewarned of everything, offered 100,000 dollars as the Government's initial contribution to the Centre. This released Abdus' full planning instincts. They lasted, I am sorry to say, for just a short time. That same year, a few months after Abdus' visit, the price of copper, Peru's biggest mineral export, fell in world markets to unthinkable depths. The Minister never got to release a cent for the proposed Centre.

Then came the visit to Cusco, the old Inca city near Machu Picchu, Peru's best known tourist attraction. "This is better than what my friends told me," said Abdus. Then, talking to the Cusco University Rector, he added: "The problem is that when I asked my friends about Cusco University, they said they didn't know there was a university in Cusco." Then and there a new summer school was planned, so learned Machu Picchu visitors could pay their visitors fee by lecturing to Andean scholars. The school came to be called Multiciencias and is still in operation.

Celebrations after the founding of the school were too heavy and Abdus got ill and returned to Lima. He was, of course, in the best hotel in town. The hotel physician slapped Abdus' forehead on entering his room. The physician did not speak English, so Abdus asked me if he was supposed to slap the man back to conform to the rites of his religion. Not so! The physician was showing off the new fad in the profession. He had set a contact thermometer on Abdus.

He recovered quickly and was cheered up by two things arriving in his room. One was a collection of Peruvian fruit and another was a letter from a Peruvian physicist writing on a general relativity problem. He ate the fruit, but said that the problem was really outside his line. He would pass it to specialists in London.

In the airport, waiting for his plane, my wife noticed that Abdus' pants were held by a string, just like what Peruvian peasants use for the same purpose. She asked him whatever had happened to his belt. It had broken several weeks before and he had found no replacement of the proper size. Later I faced the same problem with the Peruvian alpaca sweaters that he loved so much. I could not find them big enough for him.

A year ago, alas, he had thinned much, but his spirit will never cease to grow among us, his colleagues and friends all over the developing world.

VICTOR LATORRE is Professor of Physics at the Graduate School, Riccardo Palma University, and Emeritus Professor of the National Engineering University, Lima. Born in 1932, he studied at San Marcos University and at the University in Maryland where he obtained his PhD in nuclear physics. He served as a member of the ICTP Scientific Council from 1970 to 1982. He is the founder of the Peruvian Physical Society and of Multiciencias (an Andean summer programme). He is a member of the Peruvian National Research Council as well as President of the Peruvian Institute for Nuclear Energy and of the Council of the Latin American Centre for Physics.

IDEALS AND REALITIES: WORKING WITH ABDUS SALAM

Sergio Mascarenhas
University of S. Paulo
S. Carlos, Brazil

I first met Abdus Salam when by a stroke of fortune I shared an office with him in the Physics Department of Carnegie Tech in Pittsburgh in the ides of 1968. I was then a Guggenheim Fellow with the group of the late Roman Smoluchowski and he was there on a brief stay. We met again some years later in Stockholm for the creation of the International Science Foundation of which we were common proposers. I remember he and I were engaged (as usual) in a friendly dispute when Salam, who was sitting beside me, said he had no influence on my proposal to model the International Science Foundation after the ICTP. Of course people laughed when I claimed not to be under the spell of Salam.

Little did I know that this man would change both my life and that of thousands of scientists from the Third World! And more, that his magic spell made of ideals and realities, dreams and incredible accomplishments would bring a new vision of scientific and technological liberation to so many countries.

After Stockholm he invited me to Trieste as a member of a five-year planning committee of ICTP. For more than 15 years I worked closely with him to organise several areas of applied interdisciplinary sciences like biophysics, medical physics and soil physics for which he gave full support and his enthusiastic collaboration. When I first proposed a series of colleges in these areas there was some criticism that they were out of the scope of ICTP, but he gave his firm approval, fully confident that interdisciplinarity and applied sciences are essential for the development of Third World nations. And he accepted to be the Honorary President of the Third World Association of Medical Physics (TWAMP), sponsored by ICTP. I had the great opportunity to discuss with him many aspects of the Third World Academy of Sciences (TWAS) and a possible platform for his candidacy to UNESCO. One of the dreams then was to have a UNESCO satellite beaming educational, cultural and scientific programmes to the Third World in close connection with educational production centres located on different continents. The idea of a web to help jump the barriers of underdevelopment was very clear in his mind. The foundation of TWAS was a success, influencing and creating new leadership all over the world. Never before had the scientific community been so united about science and technology as the basis for progress and liberation from the chains of poverty and ignorance through self-reliance inspired by the creativity that often comes with science.

Salam was working all the time writing, talking directly to world leaders and most of all supporting young scientists who came from all over the globe to ask for orientation and help. Many came just to meet him personally, as if on a pilgrimage of the modern age inspired by love of knowledge and science. When he had more time in the beginning, I remember how we interviewed one by one all participants in the biophysics and medical physics colleges and how he listened to accounts of their difficulties at home, why they had chosen to come to biophysics or medical physics, demonstrating the tremendous personal dedication and authenticity of a man who was one of the greatest scientists of our century.

I always hoped that he would be nominated for the Nobel Prize for Peace but it seemed that fighting the war on poverty and underdevelopment was less important that being involved in real wars with guns and bombs. So this never happened, despite some timid proposals by some of us from the Third World.

Salam, as a tireless envoy for the cause of science and development, travelled all over the continents. I had the privilege of accompanying him to Mexico and China and saw the tremendous influence he exerted to help the foundation of institutions and further their association with Trieste and among themselves in regional webs.

One aspect that I would like to stress in this memorial was his profound respect for culture, related not only to science but to art. When I mentioned to him that science should be important for the preservation of works of art from the Third World, one of our greatest treasures of creativity in China, India, Egypt, Mexico and many other countries, he gave his full support for the organisation of a unique college on the theme, despite hard financial problems. This was held and was a success, paving the way for the creation of new methods for preservation, restoration and archaeometry. Not many would have had the vision and the sensibility to back these ideas.

My great joy was when he began to work in biophysics, proposing an audacious solution to the problem of chirality in biomolecules. As you may know, his proposal tried to bring his original contributions on elementary particles to molecular biophysics and the problems of the origin of life. This is still an open question, but we should not forget the dictum that "God speaks through the mouth of geniuses".

When I last saw him in Oxford he was very ill. Holding his trembling hands, I could still see in his eyes that incredible shining glitter that made his presence unforgettable to everyone who had the privilege to meet him personally and to be inspired by him.

Abdus Salam was the messenger of peace, the great scientist, the great statesman of science who called all Third World scientists to unite for the cause of freedom of knowledge and peaceful use of science as the only way to free mankind from the martyrdom of poverty and underdevelopment.

SERGIO MASCARENHAS, PhD, physicist from the University of S. Paulo, Brazil, was Director of the Biophysics and Medical Physics College at ICTP since the start of these activities in 1981, by invitation of Professor Abdus Salam. He is also President and Co-founder of the Third World Association of Medical Physics, Trieste, of which Abdus Salam was the Honorary Founding President. He is a member of the Third World Academy of Sciences, the Latin American Academy of Sciences, Fellow of the American Physical Society and former Fellow at the Institute of Advanced Study, Princeton (1996).

EXCERPTS FROM LETTERS

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8 September 1997

Dear Drs. Thompson and Hussain,

..."you will know Salam was always held in great esteem and respect by me, from my days as a research student at Imperial [College], July 1959 to July 1961, until present times."

A.J. Macfarlane
Department of Applied Mathematics and Theoretical Physics
University of Cambridge
England

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15 September 1997

My dear friends,

... "The great Abdus Salam was one of the founding fathers of the World Lab and on the occasion of the [annual World Laboratory] Assembly, I shall announce the establishment of a "gold medal" to be awarded to a young theoretical physicist every year to honour Abdus Salam's contributions to physics."

A. Zichichi
European Organisation for Nuclear Research
Geneva
Switzerland

2 November 1997

Dear Faheem and George,

... "I shall never forget what Professor Salam did for Physics and for the world. The centre in Trieste will remain a permanent memorial of his achievements."

N. Nasrallah
Lebanon

3 November 1997

Dear Professor Virasoro,

... "At my first meeting with him in 1979, Professor Salam showed his generosity, wisdom and foresight. Since then, many of our scientists are invited every year to participate in the activities of the ICTP in one capacity or another. We have benefited from the ICTP through the Associate scheme, the Federation agreements and the Training programme in Italian Laboratories. The ICTP Office of External Activities has sponsored many workshops in China."

C.W. Lung
International Centre for Materials Physics
Shenyang
China

7 November 1997

Dear Professor Virasoro,

..."I must say that Professor Salam's example is one of the guides for the scientists that, like me, work in developing countries. The need to maintain quality and educate young students to produce science at international standards was a message clearly transmitted by Abdus Salam."

F. de la Cruz
Centro Atomico Bariloche
Bariloche
Argentina

17 November 1997

Dear Professor Bertocchi,

... "At any rate, my heart and soul will definitely be present with you on this moving occasion. I still cannot accept the fact that Salam is no more; my grief is still as excruciatingly painful as it was one year ago. However, I feel comforted by your presence and the presence of my good friends at the Centre. May it continue to thrive and flourish!"

H.B. Ghassib
Faculty of Science
University of Jordan
Amman
Jordan

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21 November 1997

... "My beloved Abdus Salam.... You knew for instance that life is an inceasing fight which is adorned by the knowledge of the good made to others and of the help given to the deprived. You also knew, my dear friend, that man is a traveler on this earth. His return to the mother source is unavoidable, and one must be prepared at any time since we do not know the day, the hour, the second. Consequently, you had slowly prepared this return with patience and courage.

... The international scientific community will see to it that the ideas which you served and which budded will continue to grow, flourish and bear fruit."

E.M.K. Edée
University of Bénin
Lomé
Togo

November 1997

Dear Chairman, Colleagues,

... "I had the pleasure of meeting Professor Salam at the Conference on High Energy Physics which was held in Kiev in 1959. Later on, our acquaintance grew into a warm and friendly relationship.

Professor Salam had close contacts with the physicists of the former Soviet Union. For most of us he was not only a colleague but also a great friend. Professor Salam had a great gift for love of mankind. All his life is a brilliant example of establishing friendly ties among the peoples. The well-known scientific centre ICTP founded by him serves these noble ideas.

Professor Abdus Salam lent enormous help to Georgian physicists. My first participation in an international seminar at ICTP in 1965 and later my work at the Centre for some time almost every year were very important for me. During the Soviet period, a Federation Agreement between the ICTP and the Georgian Academy of Sciences was signed, thanks to the strong support of Professor Salam. This agreement provided our physicists with the opportunity of working at the Centre.

I am sincerely glad that the Centre honours the name of Professor Salam and continues his traditions."

A. Tavkhelidze
President of the Georgian Academy of Sciences

The editor wishes to thank
Katrina Danforth, Dilys Grilli and Pandora Pieri
for their valuable help in the preparation of the manuscript.

Guest of honour, President of Albania Rexhep Meidani, addressed the participants at the third session. To his left: Chairman M.A. Virasoro, A. Badran, R. Damiani, M.H.A. Hassan and L. Makhubu. To his right: H. Blix, G. Fonti, A. Izzo and E. Campo.

S. Durrani was the Chairman of the fourth session. To his right: Nguyen Van Hieu and Ahmed Salam. The speaker is A. Qadir.

Giuseppe Furlan chaired the first session. To his right: M.A. Virasoro, L. Fonda, L. Bertocchi, P. Budinich and N. Paver.

The second session was chaired by Riazuddin - at the centre of the photograph. To his right: G. Feldman, R. Delbourgo, D. Akyeampong and F. Hussain. To his left: G. Mack, R.P. Bambah and J. Ziman.